

Haiwee Geothermal Leasing Area

Draft Environmental Impact Statement and Draft Proposed Amendment to the California Desert Conservation Area Plan



Ridgecrest Field Office

Prepared for and under the direction of
Bureau of Land Management
Ridgecrest Field Office

April 2012

DOI No. 12-6



BLM MISSION STATEMENT

It is the mission of the Bureau of Land Management to sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations.

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United States Department of the Interior

BUREAU OF LAND MANAGEMENT

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In reply, refer to:
3200/1610(P)
CAD05000

April 2, 2012

Dear Reader:

I am pleased to announce the availability of the Haiwee Geothermal Leasing Area (HGLA) Draft Environmental Impact Statement (EIS) and Draft Proposed Amendment to the California Desert Conservation Area (CDCA) Plan. The EIS evaluates five alternatives, including the No Action and No Plan Amendment alternative, to address the potential environmental impacts of: (1) opening approximately 22,805 acres of Bureau of Land Management (BLM) managed federal mineral estate to geothermal exploration, development, and leasing; and (2) leasing approximately 4,460 acres of federal mineral estate for geothermal energy testing and development. A pending non-competitive geothermal leasing application could be approved consistent with the terms and conditions of the current CDCA Plan. If a lease application is approved, geothermal energy development would be assessed under a separate National Environmental Policy Act (NEPA) document.

This Draft EIS / Draft CDCA Proposed Plan Amendment has been prepared in accordance with the Federal Land Policy and Management Act (FLPMA) and NEPA. Public meetings to provide an overview of the document, respond to questions, and take public comments will be announced through the local media, BLM's website, and/or public mailings at least 15 days in advance of the meetings.

Comments may be submitted electronically at: cahaiwee@blm.gov, or by fax at: (951) 697-5299. Comments may also be submitted by mail to: California Desert District, 22835 Calle San Juan De Los Lagos, Moreno Valley, CA 92553, Attn: Peter Godfrey. To facilitate analysis of comments and information submitted, we encourage you to submit comments in an electronic format. Comments must be received within 90 days of the Environmental Protection Agency's publication of the Notice of Availability in the Federal Register to

assure they are considered in the Final EIS.

Your review and comments on the content of this document are critical to the success of this planning effort. If you wish to submit comments on the Draft EIS / Draft Proposed Plan Amendment, we request that you make your comments as specific as possible. Comments will be more helpful if they include suggested changes, sources, or methodologies, and reference to a section or page number. Comments containing only opinion or preferences will be considered and included as part of the decision making process, although they will not receive a formal response from the BLM.

Before including an address, phone number, email address, or other personal identifying information in your comment, be advised that your entire comment - including your personal identifying information - may be made publicly available at any time. While you can ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so.

The Draft EIS has been sent to members of the public who requested a copy and to pertinent local, state, tribal, and federal government entities. CDs of the Draft EIS may be requested through any of the options previously listed above. You may also view the Draft EIS on our web page at http://www.blm.gov/ca/st/en/fo/ridgecrest/haiwee_geothermal.html .

For additional information or clarification regarding this document or the planning process, please contact the Project Manager, Peter Godfrey, at (951) 697-5385. We extend our appreciation for your cooperation, assistance, and continued participation.

Sincerely,

A handwritten signature in black ink, appearing to read "Michael Reiland", written in a cursive style.

Michael Reiland
Acting Field Manager

EXECUTIVE SUMMARY

INTRODUCTION

The United States Department of the Interior, Bureau of Land Management (BLM) has prepared this Draft Environmental Impact Statement (EIS) and Draft Proposed Amendment to the California Desert Conservation Area (CDCA) Plan to evaluate the feasibility and potential environmental impacts of opening for lease approximately 22,805 acres of federal mineral estate for geothermal energy exploration and development. This Draft EIS analyzes the potential impacts of opening public lands to geothermal leasing and potential development of federally-owned geothermal resources in the Haiwee Geothermal Leasing Area (HGLA) in southwestern Inyo County, California. The HGLA is located east of the Inyo National Forest, west of the China Lake Naval Air Weapons Station, South of the South Haiwee Reservoir, and north of Little Lake. The BLM has the delegated authority to issue geothermal leases on federal mineral estate; specifically these federal mineral resources administered by the BLM.

A geothermal lease is for the conversion of geothermal energy into electric power. The BLM is authorized to enter into these leases as the manager of the geothermal resources included in the federal mineral estate. Leasing geothermal resources by the BLM vests with the lessee an exclusive right to future exploration and to produce and use of the geothermal resources within the lease area subject to existing laws, regulations, formal orders, and the terms, conditions and stipulations in or attached to the lease form or included as conditions of approval in permits. Lease issuance alone does not authorize any ground-disturbing activities. To explore for or develop geothermal resources, site-specific approval is required for any planned activities. Such approval could only be acquired following site and project specific National Environmental Policy Act (NEPA) and other environmental review.

PURPOSE OF AND NEED FOR ACTION

The purpose and need for amending the CDCA Plan is to establish a management framework for appropriate exploration and development of geothermal resources, based upon evaluation of the various social, land use, and environmental resources within the HGLA. The BLM's purpose and need for approving the pending lease applications for approximately 4,500 acres of federal mineral estate is to facilitate appropriate exploration and development of geothermal resources in the HGLA, consistent with the BLM's management of other important resources in the HGLA.

More specifically, the purpose of the action is to consider the role of geothermal energy and its use in responding to policy directives and congressional direction regarding (1) development of clean renewable energy, (2) meet the increasing energy demands of the nation, (3) reducing reliance on foreign energy imports, (4) reduce greenhouse gas emissions, and (5) improving national security. The purpose also includes responding to the increasing interest in geothermal leasing opportunities on federal land by “prescreening” land in the Haiwee geothermal leasing area.

The purpose includes support of Executive Order 13212, the Energy Act of 2005, Secretarial Order 3285, and California State’s Renewable Portfolio Standards (RPS) Policy. In May of 2001, then-President Bush signed Executive Order 13212, Actions to Expedite Energy-Related Projects, which directed executive departments and agencies to increase production and transmission of energy in an environmentally safe manner. Congress passed the Energy Policy Act of 2005, which encourages the leasing and development of geothermal resources on federal lands and requires the Secretary of the Interior to establish a program for reducing the backlog of geothermal lease applications by 90 percent by August 8, 2010. The Secretary of the Department of the Interior issued Order 3285 to establish the development of renewable energy as a priority for the department. The State of California has adopted an aggressive RPS policy that demonstrates a commitment to shifting its electrical generation portfolio to the production and use of renewable energy sources. California’s RPS requires that 20% of energy generated and distributed in the state is from renewable energy sources by the year 2010; by the year 2020, that requirement grows to 33%

The need for federal action and this EIS arises from three non-competitive lease applications that are currently pending with BLM for approximately 4,460 acres of federal mineral estate within the proposed HGLA. These applications were submitted prior to the passage of the Energy Act of 2005 and continue to be part of the backlog of applications that need to be acted upon. In evaluating these applications a need was also identified to allocate a broader area of designated lands (see Figures 1.1-3 and 2.2-1) as closed, open, or open with constraints to geothermal leasing. This need was accompanied by the need to consider appropriate constraints, stipulations, best management practices, and procedures to conserve resources and other uses that may be proposed for consideration by the BLM in the future.

The need for action includes consideration of a Plan Amendment to the CDCA Plan 1980 as Amended to classify the land in the HGLA as suitable or unsuitable for geothermal leasing. The Plan Amendment, if necessary, would be consistent with the determination to allocate specific lands within the HGLA as closed, open, or open with constraints to geothermal leasing.

DOCUMENT SCOPE AND LEASING AREA

This EIS analyzes the potential environmental, social, and economic effects of several alternatives. The document has been prepared in accordance with the National Environmental Policy Act (NEPA), Council of Environmental Quality's (CEQ) regulations for implementing NEPA (40 Code of Federal Regulations 1500-1508), the Department's regulations for implementing NEPA (43 CFR Part 46), and the Federal Land Policy and Management Act (FLPMA, Public Law 109-58) and its implementing regulations.

The HGLA consists of an estimated 21,233 acres of BLM administered public surface lands and approximately 1,572 acres of mineral estate where the surface lands are not federally owned; this area also includes the area subject to three pending geothermal lease applications for approximately 4,460 acres of BLM administered public lands. The lands considered for geothermal leasing are located in the Mount Diablo Meridian (see Appendix I) and generally occupy all or portions of the following 37 sections:

Township 21 South, Range 37 East, Sections 11-14, 23-26, 35-36
Township 21 South, Range 38 East, Sections 7-10, 15, 17-22, 27-34
Township 22 South, Range 37 East, Sections 1-2, 11-12
Township 22 South, Range 38 East, Sections 5-8

This document will allow BLM to classify the lands within the HGLA as to suitability for geothermal leasing. This document does not allow or authorize any ground disturbing activities. Any potential disturbance would need further evaluation under NEPA and other applicable authorities prior to the BLM making a decision regarding a specific proposed plan.

SCOPING

The Notice of Intent (NOI) for the HGLA was published in the Federal Register on September 11, 2009. The NOI also announced that the leasing of public lands will require an amendment to the CDCA Plan. Scoping documents were sent to members of the public listed on the BLM's mailing list as well as to organizations, groups, and individuals requesting copies of the materials.

The BLM conducted four public scoping meetings between October 13 and October 20, 2009, in Lone Pine, Bishop, Ridgecrest and Death Valley, California. During the scoping process, BLM received 14 comment letters and numerous verbal comments at the scoping meetings. Comments were made by members of the public, Native American Tribes, interest groups, and agency representatives. These comments related to geothermal development impacts on air quality, water resources in Rose Valley, endangered species, recreation,

agriculture, water well owners, population and housing in Inyo County, spiritually important Native American Sites, and the Coso Hot Springs. Additional comments related to potential land management plan conflicts, suggestions of alternatives, the potential need for upgrade of transmission lines or substation construction, the preservation of geothermal reservoirs, potential wastewater and heat and emission hazards to the public, noise generation levels, and transportation of construction materials and workforce.

Comments also included inquiries about the cumulative impacts of other geothermal projects in close proximity to the Haiwee area, and the conformance of the project with the CDCA Plan, the Northern and Eastern Mojave Plan, and the West Mojave Plan.

With the release of this Draft EIS, a Notice of Availability will be published in the Federal Register, and a 90-day comment period will commence. During this period, BLM will conduct formal public meetings in order to obtain additional comments from interested parties, and to discuss the analysis in this Draft EIS.

ALTERNATIVES

Alternative A: Open the Entire HGLA for Geothermal Leasing

All BLM administered public lands within the proposed HGLA would be deemed as suitable and open to geothermal exploration and leasing under this alternative. The CDCA Plan would be amended to classify all land within the HGLA open to geothermal leasing. The three pending geothermal lease applications would be authorized.

Groundwater extraction for consumptive use during exploration, development, and project operations activities may be allowed for some leasing applications, to the extent that groundwater use, in combination with all other authorized groundwater uses, does not exceed the safe yield or recharge rate to the Rose Valley Aquifer as specified by stipulation and other restrictions.

Alternative B: Close the Entire HGLA to Geothermal Exploration and Development

BLM administered public lands located within the HGLA would be closed to geothermal leasing and the CDCA Plan would be amended to close the land within the HGLA to geothermal leasing under this alternative. Consequently, the pending geothermal applications would be denied.

Alternative C: Open the HGLA to Geothermal Exploration and Development with No Surface Occupancy Allowed in Sensitive Areas (Preferred Alternative)

All BLM administered public lands within the proposed HGLA would be identified as open and available for geothermal exploration, development, and leasing under this alternative. Specific acreage within the HGLA would be identified as available for geothermal development, but subject to no surface occupancy restrictions to protect sensitive resources. The sensitive resources area restriction is defined by stipulation and is largely expressed by the recognized Mojave ground squirrel core habitat. The CDCA Plan would be amended to find all land within the HGLA as suitable for geothermal development. The three pending geothermal lease applications encompass lands both within and outside of the sensitive resources area and would be authorized, subject to these limitations.

Groundwater extraction for consumptive use will be prohibited or strictly controlled by stipulation throughout the entire HGLA.

Alternative D: Selective Closure of Sensitive Resource Areas within the HGLA for Geothermal Exploration and Development

Specific acreage within the HGLA would be identified as open and available for geothermal development. Other, separate areas within the HGLA would be identified by stipulation as closed and unavailable for geothermal development in order to protect sensitive resources. The sensitive resource area is largely expressed by the Mojave ground squirrel core habitat. The CDCA Plan would be amended to identify the sensitive resource area within the HGLA as closed and unavailable to geothermal development. The CDCA Plan would also be amended to classify the balance of the land within the HGLA as suitable for geothermal development. The three pending geothermal lease applications would be authorized, with modifications

Groundwater extraction for consumptive use will be prohibited or strictly controlled by stipulation throughout the entire HGLA.

Alternative E: No Action

This alternative would not change the current management of the BLM administered public lands within the HGLA. The CDCA Plan would not be amended and the pending applications for geothermal development would be denied.

REASONABLY FORESEEABLE DEVELOPMENT SCENARIO

The BLM has prepared a Reasonable Foreseeable Development (RFD) scenario as a basis for analyzing environmental impacts resulting from potential future leasing and development of federal geothermal resources within the HGLA. There is currently no direct data on which to base the RFD scenario, such as known temperature gradient wells or deep exploration wells within the area. Most of the HGLA, however, is within the Coso Known Geothermal Resource Area (KGRA), an area term no longer in wide use. The KRGA recognizes the potential for a geothermal resource largely due to related geologic features and structures. The Coso geothermal field is also within the KGRA and located approximately three miles southeast of the easternmost boundary of the HGLA. The Coso field is used as an analog for evaluation of geothermal resource potential within the HGLA. The Coso geothermal field is located on the China Lake Naval Air Weapons Station in proximity to the project area. The Coso geothermal field currently produces approximately 200 megawatts (MW) of electricity from a total of nine 30 MW geothermal turbine/generators. The Coso field is located in an area of relatively recent volcanic activity. This volcanic activity included intrusion of magma to shallow depths, thereby providing an accessible heat source for the geothermal field. There is likelihood that the HGLA may have a similar resource.

For the purpose of the RFD, it will be assumed that the productive areas will be less prolific than in the Coso geothermal field, the resource will be deeper, and more wells will be required per MW than in the Coso geothermal field. The RFD also assumes that two 30 MW power plants would be constructed, each of which would operate for 30 years. A total of 15 production wells and seven injection wells would be drilled over the 30-year operational life period in order to maintain the 30 MW of net production at each power plant. It was assumed that the RFD scenario could occur on any land within the HGLA, regardless of surface or mineral ownership. Total disturbance from the two plants was estimated to be 384 acres during construction and then 276 acres during operation.

ENVIRONMENTAL CONSEQUENCES

Designating lands for geothermal leasing potential, amending the CDCA Plan to allow for leasing and development, and authorizing geothermal leases do not result in any direct impacts as defined by CEQ regulations, which state that such effects “are caused by the action and occur at the same time and place” (40 CFR 1508.8). It is reasonable, however, to foresee that real impacts could occur if the BLM issues geothermal leases, but that those impacts would not occur until a separate BLM action authorized development following that lease issuance, at some point in the future. Therefore, the analysis in the Draft EIS addresses both direct and indirect impacts based on the foreseeable actions associated with leasing for development which would include exploration, drilling, and utilization. These impacts have been analyzed for the entire HGLA based on the RFD scenario. Additional site specific analysis would be conducted during the permitting review process for subsequent proposed

exploration, drilling, and utilization activities. General impacts from a proposed exploration, drilling, or utilization action could potentially occur to the following resources and uses:

- **Air Quality and Climate:** Short-term increase in air emissions associated with construction of the geothermal power plants. Minimal emissions are associated with operation of a geothermal power plant and therefore such development and operation are likely to have a beneficial impact in reducing emissions and greenhouse gases on a more regional level;
- **Noise:** Minor short term impacts in proximity of drilling and other activities in addition to minor long term impacts associated with operations;
- **Topography, Geology, Seismicity:** Minimal impacts to geology, including 384 acres of surface disturbance, and a local minor seismicity hazard associated with injection wells;
- **Soils:** Disturbance of 384 acres expected from the Reasonably Foreseeable Development would include compaction, but is less than 2% of the available acres. This would go along with some minor long-term loss of soils;
- **Water Resources:** Short-term impact during exploration and development activities;
- **Biological Resources:** Long-term loss of vegetation and habitat associated with roads and other surface disturbance. This could impact several special-status species such as the Mojave Ground Squirrel and the Desert Tortoise;
- **Cultural Resources:** Impacts would be minor or negligible due to the ability to redesign or modify projects to avoid significant disturbance;
- **Paleontology:** No adverse impacts would be expected due to the low probability of occurrence;
- **Visual Resources:** Variable long-term impact from the presence of the power plants and associated infrastructure such as wells, access roads, and power lines. Variability ranges from low to high impacts based on the point of view and the locations of the potential power plants;
- **Lands and Realty:** Impacts would be low based on recognition of existing use classifications and prior existing rights;

- **Public Health and Safety:** Impacts are expected to be low based on BLM lease conditions and applicable requirements;
- **Energy and Mineral Resources:** Potential for impacts is considered low, since geothermal development is not incompatible with mining operations;
- **Wild Horses and Burros:** There is a low expectation of occurrence due to adherence with applicable laws, regulations, and requirements;
- **Grazing:** Impacts are considered low and limited to the loss of lands available for other uses (384 acres expected from the Reasonably Foreseeable Development). There are two grazing allotments present in the HGLA with each having only about 3% to 4% of their respective allotment found within the HGLA;
- **Recreation:** Short term impacts from construction and long term impacts in the immediate vicinity of any development facilities would be low overall. It would include loss of acreage, road use conflicts, and visual impacts, but would be offset by potentially better access through new road construction;
- **Special Designations:** The potential for impacts is considered low due to consideration of current regulations and requirements;
- **Traffic / Transportation:** Impacts to traffic and transportation would be considered low since any expected increase in traffic would be a negligible increase in the regional traffic flow;
- **Socioeconomics:** Potential impacts include an increase in employment, economic benefits, and public revenue, along with other potential impacts such as the decrease in available housing and public services. These are expected to be low and short-term.

Many of the ground disturbing impacts associated with biological resources, cultural resources, earth resources, water resources, and water quality can be appropriately mitigated or avoided through site specific BMPs, stipulations, and siting designs. These can be identified during analysis performed for the evaluation of specific proposed leasing and development actions. Appropriate mitigation measures, such as avoidance and no surface occupancy, could be implemented as part of the proposed action to reduce these impacts.

Cumulative effects associated with geothermal development would be minor in nature, mainly due to the limited number of other past, present and reasonably foreseeable projects

within the planning area. Proponents of several other energy developments have applied for right-of-way grants or proposed projects within the HGLA. This is analyzed in detail in the Cumulative Effects section of Chapter 4.

ORGANIZATION OF THIS DOCUMENT

Chapter 1 provides an introduction, discussion of the purpose of and need for action, and information about the programs and policies that relate to the purpose and need. Chapter 2 presents the proposed action and a reasonable range of alternatives, including appropriate stipulations, Best Management Practices (BMPs), and procedures that are associated with geothermal leases. It also includes information on the phases of geothermal resource development, and describes BLM's reasonably foreseeable development scenario. Chapter 3 describes existing environmental conditions of the HGLA and vicinity. Chapter 4 evaluates the potential direct, indirect, and cumulative impacts of the proposed action and alternatives. Chapter 5 describes the activities that have taken place and are planned for the coordination and consultation process with the public and agencies. Chapter 6 is comprised of a list of preparers of this Draft EIS, and Chapter 7 lists the references cited in this document. There are nine appendices included in this Draft EIS (Appendices A through I).

Abbreviations and Acronyms

AAGR	annual average growth rate
AB	Administrative Bill
ACEC	Area of Critical Environmental Concern
ACHP	Advisory Council on Historic Preservation
ac-ft/yr	acre feet per year
AGD	allowable ground disturbance
AICUZ	Air Installation Compatible Use Zone
AIRFA	American Indian Religious Freedom Act
AML	Abandoned Mine Lands
AMP	Allotment Management Plans
amsl	above mean sea level
APCD	Air Pollution Control District
APE	Area of Potential Effects
APLIC	Avian Power Line Interaction Committee
AQCM	Air Quality Control Mitigation Measures
ARB	Air Resources Board
ARPA	Archaeological Resources Protection Act
ASTM	American Society for Testing and Materials
AUM	Animal Unit Months
BGEPA	Bald and Golden Eagle Protection Act
bgs	below ground surface
BLM	Bureau of Land Management
BMP	Best Management Practices
CAA	Clean Air Act
CAAQS	California Ambient Air Quality Standards
Cal-IPC	California Invasive Plant Council
Caltrans	California Department of Transportation
CARB	California Air Resources Board
CCD	Census County Division
CDCA	California Desert Conservation Area
CDFG	California Department of Fish and Game
CDOF	California Department of Finance
CDP	Census Designated Place
CDPA	California Desert Protection Act
CDWR	California Department of Water Resources

CEC	California Energy Commission
CEDD	California Employment Development Department
CEQ	Council of Environmental Quality
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
CH ₄	methane
CHL	California Historical Landmarks
CHRIS	California Historical Resource Information System
CNDDDB	California Natural Diversity Database
CNPS	California Native Plant Society
CO	carbon monoxide
CO ₂	carbon dioxide
CO ₂ e	CO ₂ equivalent
COC	Coso Operating Company
COM Plan	Construction, Operation, and Maintenance Plan
CPUC	California Public Utilities Commission
CRHR	California Register of Historical Resources
CRMP	Cultural Resource Management Plan
CRUP	Cultural Resource Use Permit
CSLC	California State Lands Commission
CSU	Controlled Surface Water
CUP	Conditional Use Permit
CWA	Clean Water Act
dB	decibels
dB(A)	A-weighted decibels
DC	Direct Current
DOGGR	California Dept of Conservation, Division of Oil, Gas & Geothermal Resources
DOI	United States Department of the Interior
DSCF	dry standard cubic feet
DWMA	Desert Wildlife Management Area
EA	Environmental Assessment
EIC	Eastern Information Center
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EMF	Electromagnetic Field

ERMA	Extensive Recreation Management Area
ESA	Endangered Species Act
°F	degrees Fahrenheit
FEMA	Federal Emergency Management Agency
FLPMA	Federal Land Policy and Management Act
FOIA	Freedom of Information Act
FR	Federal Register
Ft ² /day	square feet per day
GBUAPCD	Great Basin Unified Air Pollution Control District
G-E-M	Geology-Energy-Minerals
GHG	Green House Gas
GIS	geographic information system
GRDA	geothermal resources development account
GWP	global warming potential
HCP	habitat conservation plan
HGLA	Haiwee Geothermal Leasing Area
HMMP	Hydrologic Monitoring and Mitigation Plan
hp	horsepower
HPTP	Historic Properties Treatment Plan
H ₂ S	hydrogen sulfide
ICC	Inyo County Code
IM	Instruction Memorandum
Kf	water erosion factor
KGRA	known geothermal resource area
km	kilometer
KOP	key observation point
kph	kilometers per hour
kV	kilovolt
LADPW	Los Angeles County Department of Public Works
LADWP	Los Angeles Department of Water and Power (City of Los Angeles)
L-C-M	Lacy-Cactus-McCloud
L _{dn}	day-night average noise level
L _{eq}	equivalent, average sound level
LORS	Laws, Ordinances, Regulations and Standards

LOS	Level of Service
M	Magnitude
MBTA	Migratory Bird Treaty Act
MDM	Mt. Diablo Meridian
MEQ	micro-earthquake
mg/L	milligrams per liter
MGSCA	Mojave Ground Squirrel Conservation Area
mph	miles per hour
MUC	multiple use class
MW	megawatts
N ₂ O	nitrous oxide
N/A	not applicable
ND	No Date
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection Act
NAHC	Native American Heritage Commission
NAWS	Naval Air Weapons Station
NCEC	Northern California Earthquake Center
NCG	non-condensable gases
NEMO	Northern and Eastern Mojave
NEPA	National Environmental Policy Act
NFS	National Forest Service
NHL	National Historic Landmark
NHPA	National Historic Preservation Act of 1966
NO ₂	nitrogen dioxide
NOI	Notice of Intent
NOTS	Naval Ordnance Test Station
NO _x	oxides of nitrogen
NPDES	National Pollutant Discharge Elimination System
NPS	United States Department of the Interior, National Park Service
NRCS	Natural Resources Conservation Service
NREL	National Renewable Energy Laboratory
NRHP	National Register of Historic Places
NSO	No Surface Occupancy
O ₃	ozone
OEHHA	California Office of Environmental Health Hazard Assessment

OHP	Office of Historic Preservation (<i>in the California Department of Parks and Recreation</i>)
OHV	off-highway vehicles
Pb	lead
PFYC	Potential Fossil Yield Classification
PM ₁₀	suspended particulate matter less than or equal to 10 microns in diameter
PM _{2.5}	fine particulate matter less than or equal to 2.5 microns in diameter
ppb	parts per billion
ppm	parts per million
PRPA	Paleontological Resource Preservation Act
REIS	Regional Economic Information System
RFD	reasonably foreseeable development
RFO	Ridgecrest Field Office
RMP	Resource Management Plan
ROD	Record of Decision
ROG	reactive organic gases
ROW	right of way
RPS	Renewable Portfolio Standard
RV	recreational vehicle
RWQCB	Los Angeles County Regional Water Quality Control Board
SAA	Streambed Alteration Agreement
SB	Senate Bill
SCAB	South Coast Air Basin
SCAG	Southern California Association of Governments
SCAQMD	South Coast Air Quality Management District
SCE	Southern California Edison
SCEC	Southern California Earthquake Center
SDG&E	San Diego Gas and Electric
SHPO	State Historic Preservation Office
SIP	State Implementation Plan
SO ₂	sulfur dioxide
SPER	Statewide Portable Equipment Registrations
SQRU	Scenic Quality Rating Units
SR	State Route
SRMA	Special Recreation Management Act
SSA	socioeconomic study area
SWPPP	Stormwater Pollution Prevention Plan

SWRCB	State Water Resources Control Board
TAC	toxic air contaminants
TCP	traditional cultural properties
TDS	Total Dissolved Solids
TGA	Taylor Grazing Act
TL	timing limitations
TWRA	Tehachapi Wind Resources Area
μm	microns
$\mu\text{g}/\text{m}^3$	micrograms per cubic meter
U.S.	United States
US 395	U.S. Highway 395
USACE	United States Army Corps of Engineers
U.S.C.	United States Code
USDA	United States Department of Agriculture
USDI	United States Department of the Interior
USEPA	United States Environmental Protection Agency
USFS	United States Department of Agriculture, Forest Service
USFWS	United States Department of the Interior, Fish and Wildlife Service
USGS	United States Geological Survey
VOC	Volatile Organic Compounds
VRI	Visual Resource Inventory
VRM	Visual Resource Management
WECC	Western Electricity Coordinating Council
WEMO	West Mojave
WRCC	Western Regional Climate Center

CHAPTER 1

INTRODUCTION

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PURPOSE AND NEED

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CHAPTER 1 INTRODUCTION AND PURPOSE AND NEED

1.1 PROJECT OVERVIEW

1.1.1 Introduction

The Bureau of Land Management (BLM) is evaluating various alternatives addressing approximately 22,805 acres of BLM-administered public lands within the Haiwee Geothermal Leasing Area (HGLA) and geothermal leasing. These lands comprise an estimated 21,233 acres of surface lands that include the subsurface mineral rights and approximately 1,572 acres of “split estate” land, where the surface is not federally owned, but the mineral rights are. (See Appendix I) The HGLA is located in southwestern Inyo County, California, east of the Inyo National Forest, west of the China Lake Naval Air Weapons Station, and South of the South Haiwee Reservoir as shown in Figures 1.1-1 Regional Setting, 1.1-2 Aerial View, and 1.1-3 Designated Routes. In addition to federally owned lands, the HGLA also includes state and privately owned lands, as well as some acres that are mixed estate, or private surface ownership with federal mineral resource ownership. The lands within the HGLA are located in the Mount Diablo Meridian (see Appendix I) and occupy all or certain portions of the following 38 sections:

Township 21 South, Range 37 East, Sections 11-14, 23-26, 35-36

Township 21 South, Range 38 East, Sections 7-10, 15, 16-22, 27-34

Township 22 South, Range 37 East, Sections 1-2, 11-12

Township 22 South, Range 38 East, Sections 5-8

There are currently three pending geothermal lease applications covering about 4,460 acres of BLM-administered public lands in this area (See Figure 1.1-3). These applications have been serialized as CACA 43998 (approximately 1,280 acres), CACA 43993 (approximately 2,540 acres), and CACA 44082 (approximately 640 acres). The BLM will decide whether or not to amend the CDCA Plan to make all or a portion of the HGLA available to geothermal leasing and development. The BLM will also decide whether or not to issue leases for one or more of these three pending lease applications.

Geothermal resources are federal mineral resources administered by the BLM. Amending a land use plan to allow the leasing of geothermal resources and issuing leases of geothermal resources on federally administered public lands are federal actions subject to compliance with the National Environmental Policy Act (NEPA). The BLM has prepared this Environmental Impact Statement (EIS) and Proposed Plan Amendments in compliance with the NEPA Council on Environmental Quality (CEQ) Regulations (40 CFR 1500-1508) and the Federal Land Policy and Management Act (FLPMA) of 1976 (Public Law 94-579)

respectfully. The EIS analyzes and discusses the feasibility and potential environmental impacts of geothermal leasing of federally administered public lands within the HGLA.

Route designation changes may be made in the future as a part of development projects, if approved. (See Figure 1.1-3 for currently designated routes.) A project-specific NEPA analysis would be required for route designation changes and generally this process would not require a plan amendment. This approach to route management would be in accordance with the BLM's Comprehensive Travel and Transportation Management policy (IM 2008-14) and BLM Manual 1601, Appendix C, Section II D.

The BLM proposes to amend the CDCA Plan to incorporate decisions concerning the availability of all or part of the HGLA for geothermal exploration and development. In addition, the BLM proposes to grant each of the three leases identified above. As detailed below, the purpose and need for amending the CDCA Plan is to establish a management framework based upon evaluation of the various social, land use, and environmental resources within the HGLA, with a focus on appropriate exploration and development of geothermal resources, as well as consideration of other renewable resources (wind and solar energy). The BLM's purpose and need for granting the pending leases is to facilitate appropriate exploration and development of geothermal resources in the HGLA, consistent with the BLM's management of other important resources in the HGLA. The BLM does not authorize any specific energy development or FLPMA right of way based on the decisions from this EIS. Issuance of a lease for geothermal resources lays the groundwork for future exploration and development, but does not confer the right for any activities involving ground disturbance or activities that may impact the resources of the lease area. Any future geothermal project or other energy exploration and development that may be proposed within the HGLA will be evaluated under a separate NEPA analysis on a site and project-specific basis.

FIGURE 1.1-1 Regional Setting with Vicinity Projects

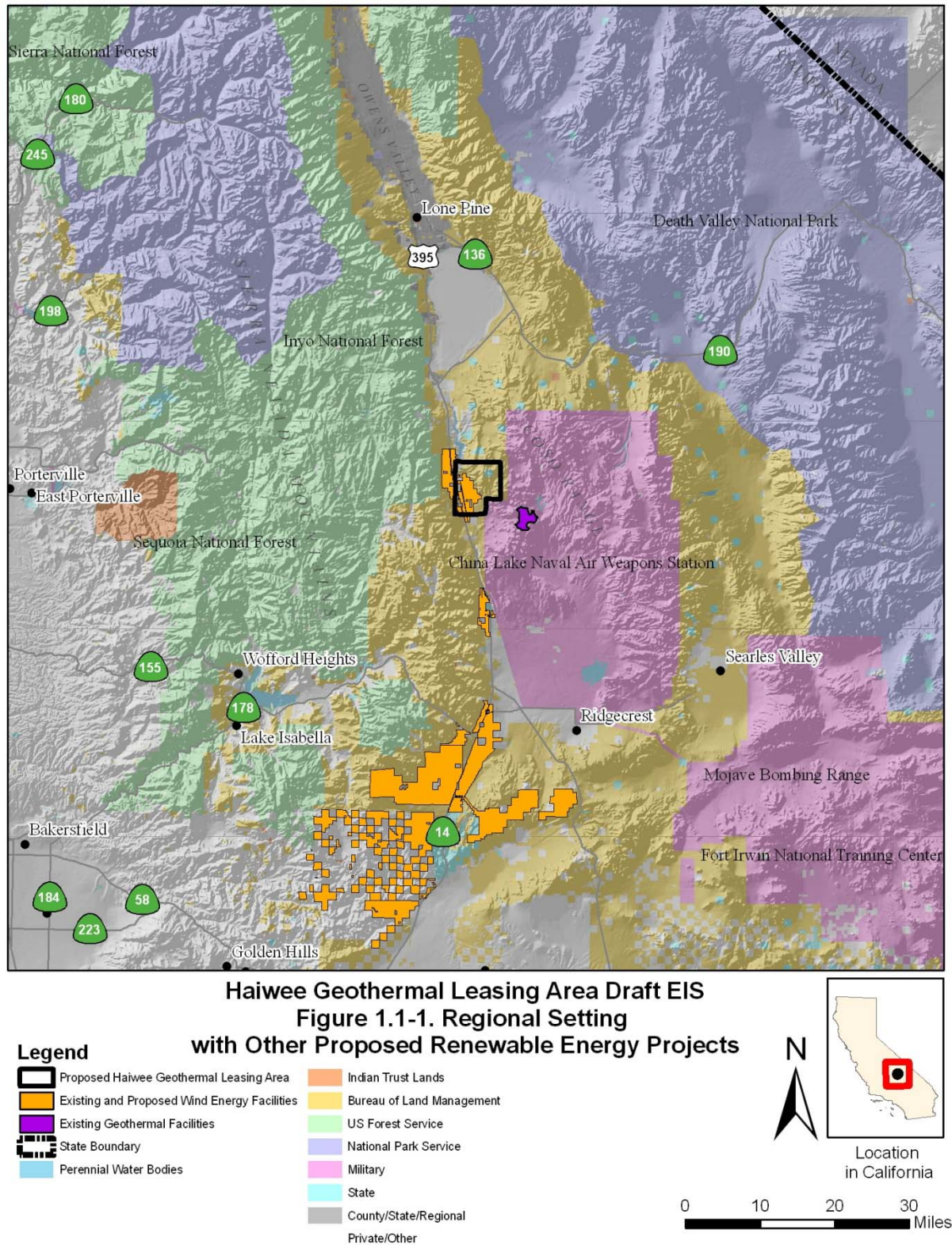


FIGURE 1.1-2 Aerial View

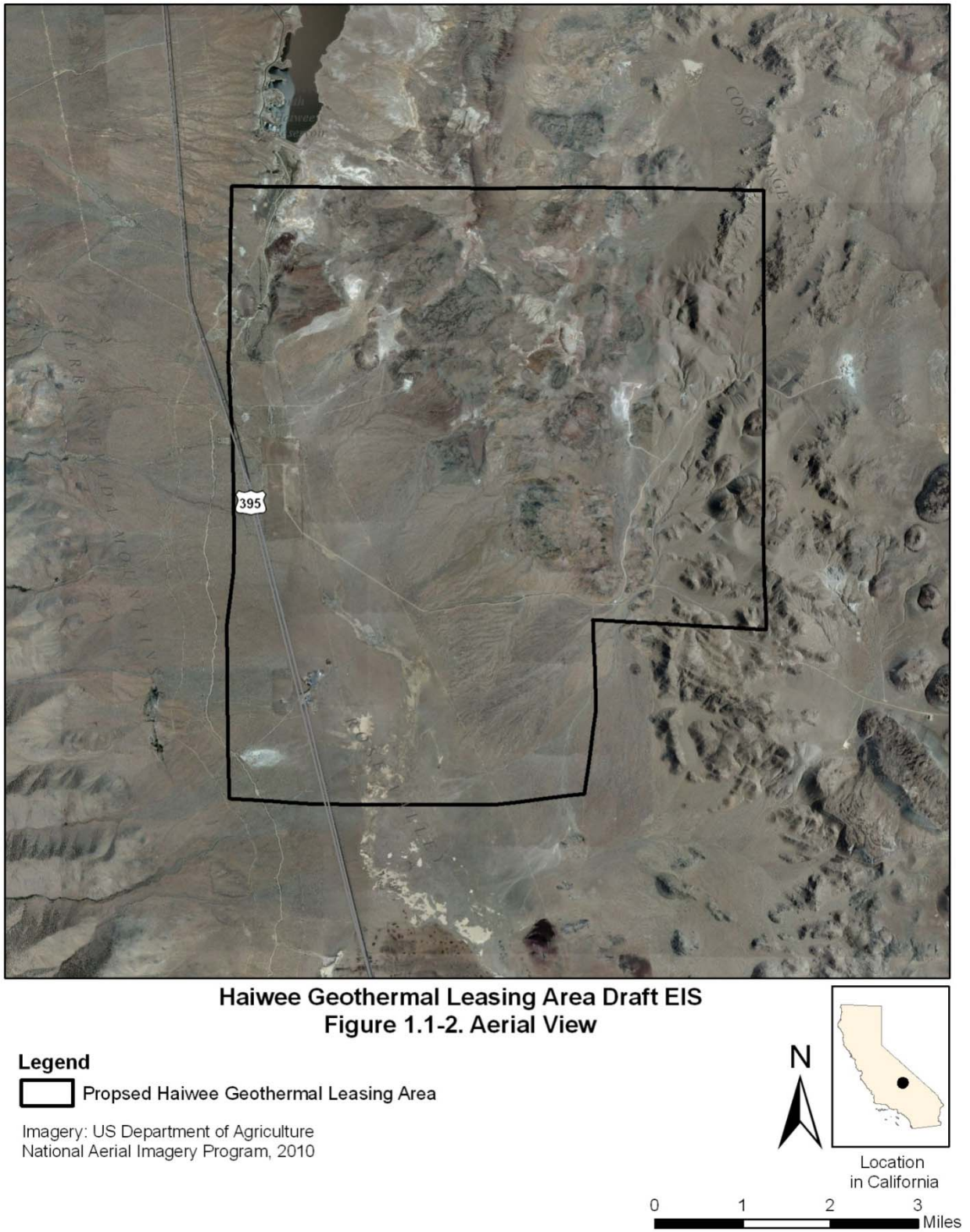
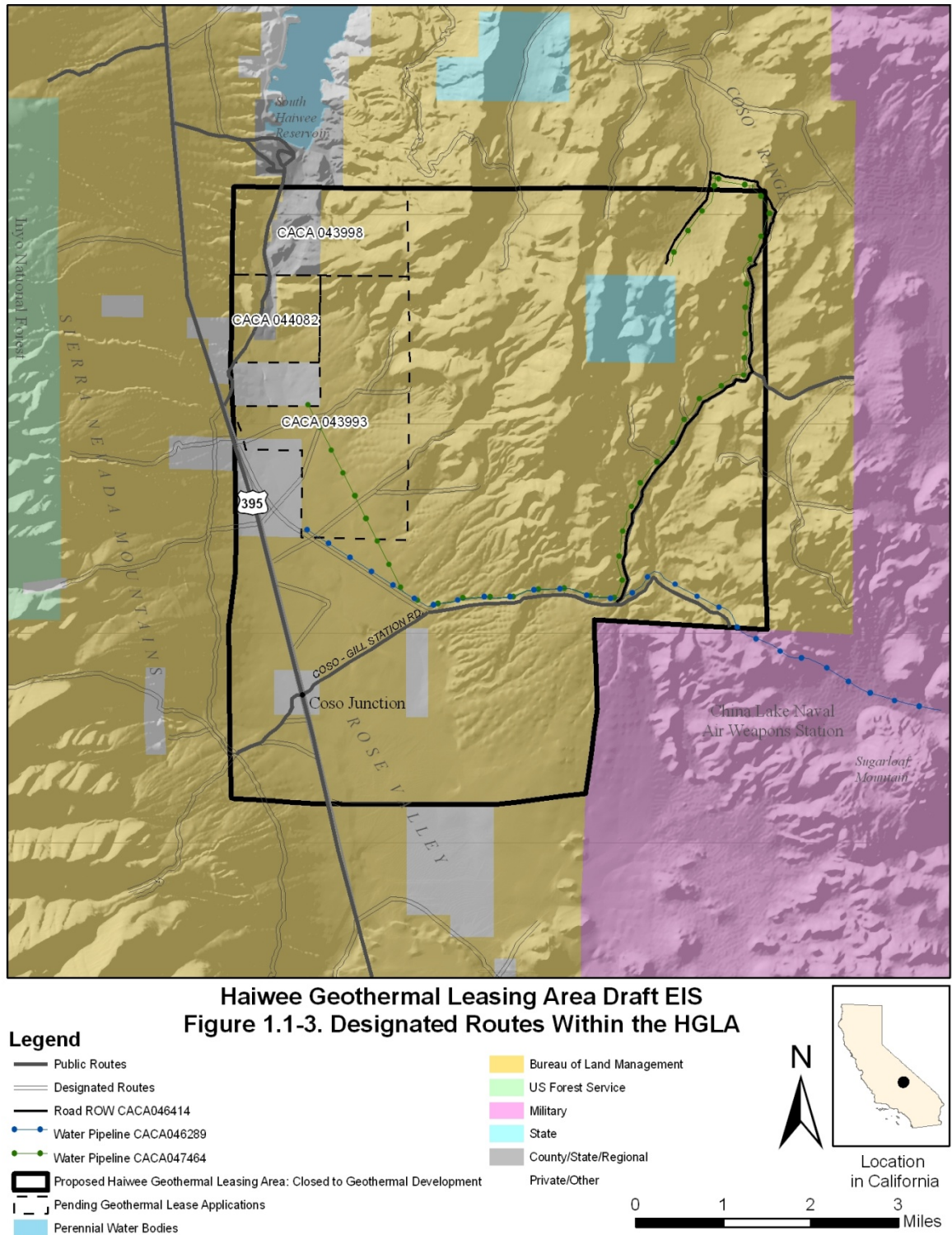


FIGURE 1.1-3 Designated Routes and Pending Geothermal Lease Applications



1.2 BLM PURPOSE AND NEED FOR THE PROPOSED ACTION

1.2.1 Purpose of Action

The purpose of the action is to consider the role and use of geothermal energy with regard to (1) developing clean renewable energy, (2) meeting the increasing energy demands of the nation, (3) reducing reliance on foreign energy imports, (4) reducing greenhouse gas emissions, and (5) improving national security. The purpose also includes responding to the increasing interest in geothermal leasing opportunities on federal land by addressing three pending geothermal lease applications and by “prescreening” land in the HGLA for its suitability for this kind of development through the planning process.

The purpose includes support of Executive Order 13212, the Energy Policy Act of 2005, Secretarial Order 3285, and California State’s Renewable Portfolio Standards (RPS) Policy. On May 18, 2001 President George W. Bush signed Executive Order 13212: Actions to Expedite Energy-Related Projects, which directed executive departments and agencies to increase production and transmission of energy in an environmentally safe manner. Congress passed the Energy Policy Act of 2005, which encourages the leasing and development of geothermal resources on federal lands and requires the Secretary of the Interior to establish a program for reducing the backlog of geothermal lease applications by 90 percent by August 8, 2010. The State of California has committed to an aggressive RPS policy that shifts its generation portfolio to the production and use of renewable energy sources. California’s RPS requires that 33 percent of energy generated and distributed in the state be produced from renewable energy sources by the year 2020.

1.2.1.1 Executive Order 13212

Executive Order 13212: Actions to Expedite Energy-Related Projects states, “The increased production and transmission of energy in a safe and environmentally sound manner is essential.” Executive departments and agencies were directed to “take appropriate actions, to the extent consistent with applicable law, to expedite projects that will increase the production, transmission, or conservation of energy.” Executive Order 13212 further states, “For energy-related projects, agencies shall expedite their review of permits or take other actions as necessary to accelerate the completion of such projects, while maintaining safety, public health, and environmental protections. The agencies shall take such actions to the extent permitted by law and regulation and where appropriate.”

1.2.1.2 Energy Policy Act of 2005

The Energy Policy Act of 2005 encourages the leasing and development of geothermal resources on federal lands. Specifically, Section 225 of the Act requires the Secretary of the Interior to establish a program for reducing the backlog of geothermal lease applications that were pending as of January 1, 2005 by 90 percent. This backlog has now been addressed.

Section 211 of the Act also provides a ten-year goal for the Secretary of the Interior to seek approval of non-hydropower renewable energy projects located on public lands with a total generation capacity for all projects of at least 10,000 megawatts of electricity, including electricity from geothermal resources.

Section 222(d)(1) of the Energy Policy Act of 2005 states, “It shall be a priority for the Secretary of the Interior to ensure timely completion of administrative actions, including amendments to applicable Resource Management Plans (RMP), necessary to process applications for geothermal leasing pending on the date of enactment of this subsection.” This section also contains the requirement that, “all future RMPs for areas with high geothermal resource potential shall consider geothermal leasing and development.”

1.2.1.3 Secretarial Order 3285

This Order establishes the development of renewable energy as a priority for the Department of the Interior and establishes a Departmental Task Force on Energy and Climate Change. This Order also amends and clarifies Departmental roles and responsibilities to accomplish this goal.

1.2.1.4 Assist State of California in Meeting its Renewable Portfolio Standard Goals

The opening of federal lands to geothermal leasing may assist the state of California in meeting its Renewable Portfolio Standard (RPS) goal of 33 percent of its energy derived from renewable resources by the year 2020. Geothermal energy is a renewable resource that provides reliable and consistent base load power, unlike solar or wind power generation, which are intermittent renewable energy sources. Geothermal development has the potential to make notable contributions to meeting the state’s RPS goals.

1.2.2 Need for the Action

The need for action is to allocate specific lands in the HGLA as closed, open, or open with constraints to geothermal leasing. This EIS arises from three non-competitive lease applications that are currently pending with the BLM for approximately 4,460 acres of federal mineral estate. The need for action includes making a leasing decision for each of the three applications to grant, deny, or grant with modifications. These applications were received prior to the passage of the Energy Policy Act of 2005, and thus are included with others in the backlog covered by the requirement mentioned above.

In addition to the acreage covered by the pending lease applications, the BLM has identified approximately 18,000 acres of BLM-administered lands that may have potential to contain geothermal resources. These identified lands are located within the HGLA and are adjacent to the three pending leases along with approximately 1,630 acres of private land. For the public land and the portions of this private land for which BLM owns the mineral rights, the

need for action includes determining whether these lands, or portions thereof, should be available for geothermal leasing.

The need for action includes making a determination about what terms, conditions and stipulations for development may apply, should any lands within the HGLA be made open for geothermal energy exploration and development.

1.2.2.1 Amend the CDCA Plan

The CDCA encompasses 25 million acres of land in Southern California designated by Congress through the Federal Land Policy and Management Act (FLPMA) of 1976. The BLM directly administers about 10 million acres of the CDCA, which includes the HGLA. The CDCA Plan provides overall regional guidance for management of the public lands within the CDCA, and establishes long-term goals for protection and use of the California Desert.

The need for action is to consider whether the CDCA Plan should be amended to make the HGLA, or portions thereof,

- Available to geothermal leasing with standard terms and conditions
- Available to geothermal leasing with additional stipulations or
- Unavailable.

The HGLA is located on land designated as multiple use class L – limited use land. Geothermal facilities may only be permitted on Class L land when specific NEPA requirements are met and the lands are identified as available for geothermal leasing. Currently, the CDCA Plan requires that projects for power generation or transmission, not already identified in the plan, be considered through the plan amendment process. As part of this planning process, the BLM would consider whether to amend the plan to allow projects for geothermal power generation, or transmission, in the HGLA following receipt of an acceptable plan of development and site specific analysis under NEPA. Should the HGLA, or some portion, be identified as available to geothermal leasing under the CDCA Plan, then any subsequent geothermal lease located within the HGLA would not require a site-specific plan amendment.

1.3 BLM AUTHORIZATIONS

The Geothermal Steam Act of 1970 (84 Stat, 1566; 30 U.S.C. 1001-1025), as amended by the Energy Policy Act of 2005, provides the Secretary of the Interior with the authority to lease public and federal lands for geothermal exploration and development in an environmentally sound manner. New federal geothermal development regulations (43 CFR Parts 3000, 3200, and 3280-Geothermal Resource Leasing and Geothermal Resources Unit Agreements) became effective June 1, 2007. It is the policy of the federal government, consistent with Section 2 of the Mining and Mineral Policy Act of 1970 and Sections 102(a)(7), (8), and (12) of the FLPMA of 1976, to encourage the development of mineral resources, including geothermal resources, on federal lands. The BLM has been delegated the authority to issue geothermal leases and implement the Geothermal Steam Act through the regulations contained in 43 CFR Part 3200.

1.3.1 Regulatory Framework

The BLM considers competitive geothermal energy leases under the Geothermal Steam Act of 1970, as amended (30 United States Code [U.S.C.] 1001-1025) and the Energy Policy Act of 2005 (Public Law [Pub. L.] 109-58). Lands for geothermal energy development, which are nominated for leasing by geothermal developers, must first be identified as suitable for these purposes in a land-use plan prepared according to Section 202 of FLPMA.

1.3.1.1 Leasing Geothermal Resources

Geothermal resources are underground reservoirs of heat. This heat is generated from natural sources within the earth and can create or be used to produce hot water or steam. Natural geothermal steam and hot water can reach the surface of the earth in the form of hot springs, geysers, mud pots, or steam vents. Geothermal heat can also be accessed by wells, and that heat energy can be transferred to generate electricity or for other direct uses such as heating greenhouses and aquaculture operations.

On May 2, 2007, the BLM issued new regulations governing geothermal resources (Federal Register [FR], May 2, 2007, Volume 72, Number 84, Part II). The new rule stated that State Offices that received nominations or expressions of interest filed before August 8, 2005, (the “date of enactment” of the Energy Policy Act), may offer those lands, if available, for competitive leasing under the revised geothermal regulations. Instructional Memorandum (IM) 2009-022, issued on October 9, 2009, provided additional guidance on implementing the new rule. Regulations in existence at the time of the non-competitive lease applications would govern those leases, should they be issued. Any future competitive leases would be

regulated under the new rule. The non-competitive leases issued under the old rule could be converted to the new rule, if so desired by the lessees.

Under the new rule, geothermal leases would be granted for a primary term of ten years, with two extensions of up to five years each (43 CFR 3206.17 and 3208.10). The terms of the lease require the lessee to show a certain level of diligence toward developing the geothermal resources within the lease area or the lease may be terminated. Once an area is developed for productive use of geothermal energy, the lease allows the lessee use of the resource for 40 years (43 CFR 3207.10), with a right of renewal for up to another 40 years (43 CFR 3207.11). Geothermal exploration and production on federal land conducted through leases is subject to terms and stipulations to comply with all applicable federal and state laws pertaining to various considerations for sanitation, water quality, wildlife, safety, cultural resource protection, and reclamation. Lease stipulations may be site-specific and are derived from the environmental analysis process (BLM 2002).

All of the federal lands within the HGLA which may be considered for geothermal leasing under this EIS may include the following special stipulation (SA-HGLA-2) requiring unitization to protect the federal interest, to prevent waste and to limit the environmental impacts of geothermal exploration and development activities (43 CFR 3280.4):

UNITIZATION STIPULATION The lessee shall fully commit the lease to a geothermal unit acceptable to the Bureau of Land Management within 6 months of the effective date of the lease. Failure to commit the lease to a geothermal unit acceptable to the Bureau of Land Management shall subject the lease to cancellation.

A comprehensive list of the stipulations which may be applied to newly issued geothermal leases is included in Section 2.6.

Unitization of lands leased for geothermal exploration, development, and utilization is an effective tool to allow for the efficient use of the geothermal resources while minimizing the surface impacts from such utilization. When leased lands are unitized, a single operator, known as the Unit Operator, is selected by the various lessees and their interests to conduct exploration and development activities on their behalf within the unit, without regard to lease boundaries or lease ownership. The various lessees and interests all share in the cost of exploration as well as the benefits from production of any discovered commercial resource. Through this process, the Unit Operator is able to propose a reasonable plan to the BLM for exploring for the geothermal resource based upon the geology, not the land status. It also avoids the situation where each and every lessee may conduct exploration activities on their lease and independent of the other lease holders in the immediate area, which can result in greater impacts on both surface and subsurface resources. Since unitization can and does

reduce the overall impacts on a given area under lease, a requirement for the federal geothermal lessees to unitize their interests can be considered an effective tool to help mitigate the potential impact on surface uses, including recreational use.

Certain lands are designated as known geothermal resource areas (KGRAs) and are offered only through a competitive bid process. KGRAs are areas with a competitive interest in geothermal resource development and where the BLM has identified, via geologic and technical evidence, as capable of commercial production of geothermal fluids. There is no single criterion for KGRA designation. The intent of the competitive lease approach is to allow the public to receive a market value for leasing the right to develop these resources. Until the passage of the Energy Policy Act, lands outside KGRAs could be leased noncompetitively. Some of the lands within the HGLA were not within a KGRA at that time and were open to noncompetitive leasing up until the passage of the Energy Policy Act.

The pending lease applications within the HGLA were filed prior to the Energy Policy Act, and are therefore considered to be noncompetitive applications.

Section 222 of the Energy Policy Act modified the Geothermal Steam Act to require competitive lease sales for federal geothermal resources. Noncompetitive leases would be allowed for tracts that do not receive bids in a competitive lease sale. Under 43 CFR 3202.10:

(a) BLM may issue (geothermal) leases on:

- (1) Lands administered by the U.S. Department of the Interior, including public and acquired lands not withdrawn from such use;
- (2) Lands administered by the U.S. Department of Agriculture with its concurrence;
- (3) Lands conveyed by the United States where the geothermal resources were reserved to the United States; and
- (4) Lands subject to Section 24 of the Federal Power Act, as amended (16 U.S.C. 818), with the concurrence of the Secretary of Energy.

(b) If your activities under your lease or permit might adversely affect a significant thermal feature of a National Park System unit, BLM will include stipulations to protect this thermal feature in your lease or permit. These stipulations will be added, if necessary, when your lease or permit is issued, extended, renewed, or modified.

Lands that are not available for leasing are identified in 43 CFR 3201.11 as follows:

- (a) Lands where the Secretary has determined that issuing the lease would cause unnecessary or undue degradation of public lands and resources;
- (b) Lands contained within a unit of the National Park System, or otherwise administered by the National Park Service;
- (c) Lands within a National Recreation Area;
- (d) Lands where the Secretary determines after notice and comment that geothermal operations, including exploration, development or utilization of lands, are reasonably likely to result in a significant adverse effect on a significant thermal feature within a unit of the National Park System;
- (e) Fish hatcheries or wildlife management areas administered by the Secretary;
- (f) Indian trust or restricted lands within or outside the boundaries of Indian reservations;
- (g) The Island Park Geothermal Area; and
- (h) Lands where Section 43 of the Mineral Leasing Act (30 U.S.C. 226-3) prohibits geothermal leasing, including:
 - (1) Wilderness areas or wilderness study areas administered by BLM or other surface management agencies;
 - (2) Lands designated by Congress as wilderness study areas, except where the statute designating the study area specifically allows leasing to continue; and
 - (3) Lands within areas allocated for wilderness or further planning in Executive Communication 1504, Ninety-Sixth Congress (House Document 96-119), unless such lands are allocated to uses other than wilderness by a land and resource management plan or are released to uses other than wilderness by an Act of Congress.

No specific areas within the HGLA were closed to geothermal leasing or solar or wind ROW grant applications in the CDCA Plan. The analysis in this EIS may identify timing and location restrictions for future surface use within leased areas.

Lease applications, in accordance with provisions of the Geothermal Steam Act, are generally submitted for at least one full section of land, which is a mapped area of 1 square mile, or 640 acres. As a result, while lease applications may be submitted for more than one

section, and while applications may be approved for less than one section, the section is the basic geographic unit that is used for analysis in this EIS.

1.4 NEPA, FLPMA, AND CDCA PLAN

1.4.1 National Environmental Policy Act (NEPA) of 1969

The NEPA requires federal agencies to review the effects of its “major federal actions” on the natural and human-made environment prior to taking action. The review process helps both federal officials and the public understand the environmental consequences of all major projects and actions including those that protect, restore, and enhance the environment. This law requires all federal actions that could result in a significant impact on the environment to be subject to review by federal, tribal, state and local environmental authorities, as well as by affected parties and interested citizens.

1.4.2 Federal Land Policy and Management Act (FLPMA) of 1976

The FLPMA mandates that multiple use and sustained yield principles govern the management of public lands. The FLPMA provides the BLM’s overarching mandate to manage the public lands and resources under its stewardship. Multiple Use is the concept that directs management of public lands and their resource values in a way that best meets the present and future needs of Americans, and is defined as “a combination of balanced and diverse resource uses that takes into account the long-term needs of future generations for renewable and nonrenewable resources (FLPMA Section 103(c)).” Sustained yield is defined as “the achievement and maintenance in perpetuity of a high-level annual or regular periodic output of the various renewable resources of the public lands consistent with multiple use” (FLPMA Section 103(h)).

1.4.3 California Desert Conservation Area (CDCA) Plan (1980), as Amended

The HGLA is located within the BLM’s Multiple Use Class (MUC) “Class L” lands. MUC Class L lands protect sensitive, natural, scenic, ecological, and cultural resource values and are “managed to provide for generally lower-intensity, carefully controlled multiple use of resources, while ensuring that sensitive values are not significantly diminished.” However, it is important to note that, for MUC Class L lands, geothermal electrical generation facilities may be allowed pursuant to licenses issued under 43 CFR Section 3273 (Geothermal Resource Leasing), as long as all applicable NEPA requirements are met (CDCA Plan, page 90).

The CDCA Plan also designated major Energy Production and Utility Corridors to consolidate compatible rights of way, avoid sensitive resources, site ongoing projects for which decisions have been made, and site future transmission lines (CDCA Plan, Map 16). One goal of this element of the plan is to identify potential sites for geothermal development. Another goal is to fully implement use of transmission corridors to meet utility demand. Utility Corridor A runs north and south along existing transmission lines on the east side and adjacent to U.S. Highway 395 (US 395), and contains a 500 kV, 230 kV, and 138 kV transmission line. In 1984, the CDCA Plan was amended to establish a second one-mile wide, five-mile long corridor that runs generally east to west and serves to connect the Coso Known Geothermal Resource Area with Utility Corridor A. This corridor currently includes a 115 kV transmission line and a buried telephone cable line (BLM California Serial Numbers CACA 13510 and CACA 18885) that were previously authorized to the California Energy Commission, and subsequently assigned to Coso Power Developers, Coso Finance Partners, and Coso Energy Developers. The identification of geothermal potential in the HGLA and the development of any resource that may be found there, meets CDCA Plan goals.

The CDCA Plan also includes a Geology-Energy-Minerals (G-E-M) resource element, which defines the following goals for G-E-M resources:

- Within the multiple-use management framework, assure the availability of known mineral resource lands for exploration and development.
- Encourage the development of mineral resources in a manner which satisfies national and local needs, and provides for economically and environmentally sound exploration, extraction, and reclamation processes.
- Develop a mineral resource inventory, G-E-M database, and professional, technical, and managerial staff knowledgeable in mineral exploration and development.

Specific objectives of the G-E-M element are:

- To continue to recognize ways of access and opportunities for exploration and development on public lands assessed to have potential for critical mineral resources, minerals of national defense importance, minerals of which the United States imports 50 percent or more, and minerals of which the United States is a net exporter.
- To continue to recognize ways of access and opportunities for exploration and development on public lands assessed to have potential for energy mineral resources.

These are geothermal, oil, gas, uranium, and thorium, considered to be paramount priorities both nationally and within the State of California.

1.5 OTHER APPLICABLE LAWS, PLANS, AND PROGRAMS

1.5.1 State of California Renewable Portfolio Standard Program

Renewable portfolio standards are state laws requiring electric utility providers to obtain a minimum percentage of their energy from renewable generation sources such as geothermal, wind, solar, hydroelectric, biomass and tidal. Although future geothermal developments in the HGLA would represent a federal action taking place on federal land, the development of geothermal resources in the HGLA would also assist the State of California with its Renewable Portfolio Standard goals that, according to Executive Order S-14-08, call for 33 percent of California's energy to be derived from renewable sources by the year 2020.

1.5.2 Geothermal Steam Act of 1970, as Amended

The Geothermal Steam Act, as amended, governs the leasing of geothermal steam and related resources on public lands (30 USC §1001 et seq.). This Act authorizes the Secretary of the Interior to issue leases for development of geothermal resources, and also prohibits leasing on a variety of public lands, such as those administered by the U.S. Fish and Wildlife Service.

1.5.3 Mining and Minerals Policy Act of 1970

Section 2 of the Mining and Mineral Policy Act of 1970 formally recognized the importance of mining and domestic minerals production as a policy of the United States. It encouraged the development of mineral resources, including geothermal resources, on federal lands.

1.5.4 West Mojave (WEMO) Plan

The WEMO Plan covers 9.3 million acres of land including 3.4 million acres of public lands, three million acres of privately owned lands, and the balance owned by the Department of Defense. The WEMO Plan amended the CDCA Plan in June 2006.

Among other things, the WEMO Plan designated the Mojave Ground Squirrel Conservation Area (MGSCA). The HGLA falls entirely within the designated MGSCA. New ground disturbance within the MGSCA is limited to one percent (1%) of existing habitat (WEMO, 2006). New ground disturbance includes any clearing; excavating, grading, or other

manipulation of the terrain on BLM administered land and which occurs after adoption of the WEMO Plan. The BLM established a jurisdictional threshold of 10,387 acres of allowable ground disturbance on BLM administered land for the 30-year term of the WEMO Plan.

1.5.5 Energy Policy Act of 2005

The Energy Policy Act established a comprehensive, long-range national energy policy. It provides incentives for traditional energy production as well as newer, more efficient energy technologies and conservation. The Energy Policy Act contains several provisions related to geothermal energy to make it more competitive with traditional methods of energy production. It also amended the Geothermal Steam Act in several ways, which are discussed throughout this EIS.

1.5.6 Clean Air Act

The Clean Air Act (CAA), as amended, regulates air pollution to improve air quality. This Act regulates air emissions from stationary and mobile sources. This law also authorizes the U.S. Environmental Protection Agency to establish National Ambient Air Quality Standards (NAAQS) to protect public health and the environment.

1.5.7 Clean Water Act

The Clean Water Act (CWA) regulates discharges of pollutants into the waters of the United States. This Act established requirements to set water quality standards for all contaminants in surface waters. The CWA makes it unlawful for any person to discharge any pollutant from a point source into navigable waters of the US, unless a permit is first obtained under its provision.

1.5.8 Endangered Species Act of 1973

The Endangered Species Act of 1973, as amended, provides for the federal protection of threatened and endangered plants and animals. The U.S. Fish and Wildlife Service and the National Oceanic and Atmospheric Administration administer the Endangered Species Act. The major components of the Act include: (1) provisions for the listing of threatened and endangered species, (2) the requirement for consultation with the U.S. Fish and Wildlife Service on federal projects, (3) prohibitions against the taking of listed species, and (4) provisions for permits to allow the incidental taking of threatened and endangered species.

1.5.9 National Historic Preservation Act of 1966

The National Historic Preservation Act of 1966 (Public Law 89-665, as amended by Public Law 96-515; 16 U.S.C. 470 et seq.), provides for the establishment of the National Register of Historic Places (NRHP), which includes historic properties such as districts, sites, buildings, structures, and objects that are significant in American history, architecture, archaeology, and culture. Section 106 of the Act requires federal agencies with jurisdiction over a proposed federal project to take into account the effect of any undertakings, including the proposed action considered here, on listed or eligible historic resources on the NRHP. It also affords the State Historic Preservation Office and the Advisory Council on Historic Preservation an opportunity to comment regarding the proposed action. The NRHP eligibility criteria have been defined by the Secretary of the Interior's Standards for Evaluation (36 CFR 60).

1.5.10 Programmatic EIS for Geothermal Leasing in the Western United States (2008)

In October 2008, the BLM published the Final Programmatic EIS for Geothermal Leasing in the Western United States. It addressed geothermal leasing on lands administered by the BLM and the USFS in twelve western states including Alaska. Specific to the BLM, the Record of Decision of the Final Programmatic EIS approved the BLM's decision to facilitate geothermal leasing of the federal mineral estate in these 12 western states. This decision: (1) allocates BLM lands as open to be considered for geothermal leasing or closed for geothermal leasing (2) develops a reasonably foreseeable development scenario that indicates a potential for 12,210 MW of electrical generating capacity from 244 power plants by 2025; plus additional direct uses of geothermal resources, and (3) adopts stipulations, BMPs, and procedures for geothermal leasing and development on BLM-administered lands.

The HGLA was not analyzed in the 2008 Final Programmatic EIS for Geothermal Leasing in the Western United States; however, many of the relevant stipulations and BMPs within the Final Programmatic EIS have been incorporated into the analyses within the HGLA EIS so that they become elements of the CDCA plan through this plan amendment process.

1.5.11 Coso Junction PM₁₀ State Implementation Plan

The HGLA is located within the Coso Junction PM₁₀ planning area, which falls under the jurisdiction of the Great Basin Unified Air Pollution Control District (GBUAPCD). The GBUAPCD regulates stationary sources of air emissions in the HGLA. Stationary sources, such as geothermal plants that have the potential to emit pollutants into the air, are subject to the rules and regulations adopted by the GBUAPCD.

As part of the PM₁₀ attainment planning process, the GBUAPCD has adopted the State Implementation Plan (SIP) for the Coso Junction PM₁₀ Planning Area (GBUAPCD 2004). The SIP indicated that attainment of the PM₁₀ standard for the Coso Junction area is dependent on emission reductions in Owens Valley.

Within the Coso Junction area of the Great Basin Valleys Air Basin, which occupies the same area as the GBUAPCD, if net annual emissions of PM₁₀ increase by less than 100 tons, a California Air Act (CAA) conformity determination is not required. Within the Owens Valley area, the *de minimis* threshold for PM₁₀ is 70 tons per year because the area is classified as a serious nonattainment area for PM₁₀. If emissions of PM₁₀ in these areas exceed the *de minimis* threshold, the BLM must demonstrate conformity under one of the methods prescribed by GBUAPCD Regulation 13.

The Coso Junction area is considered an unclassified/attainment area for ozone and hydrogen sulfide (H₂S). As such, a CAA conformity determination would not be required for sources of ozone precursors or sources of H₂S. As discussed above, the developers of new stationary sources of air emissions must consult and coordinate with the GBUAPCD to obtain the necessary permits to construct and operate a facility, and must comply with applicable rules and regulations.

1.5.12 Inyo County General Plan

The Inyo County General Plan is a comprehensive land use plan that provides the county with a consistent framework for land use decision making. The plan covers the following elements: land use, circulation, housing, conservation, open-space, noise, safety, government, and economic development. Geothermal energy development is addressed in one of the Plan's nine elements; Conservation/Open Space Element.

The 2001 Inyo County General Plan Update was approved by the Inyo County Board of Supervisors on December 11, 2001. State law requires each county and city to prepare and adopt a comprehensive and long-range general plan for its physical development (Government Code Section 65300). A comprehensive general plan provides the County with a consistent framework for land use decision-making. All alternatives in the Haiwee Geothermal Leasing Area Draft Environmental Impact Statement and Draft Plan Amendment are consistent with the 2001 Inyo County General Plan.

1.5.13 Inyo County Water Policy

State law does not regulate groundwater management, but allows local governmental entities the latitude to regulate this resource as needed. The Inyo County Board of Supervisors adopted the Water Policy (Resolution 99-43) in July 1999 (replacing earlier water policies).

This policy established the Inyo County Water Commission and the Inyo County Water Department to regulate water resources within the county. These entities were created principally to regulate the relationship between the county and the Los Angeles Department of Water and Power.

“That policy is to protect the County's environment, citizens and economy from adverse effects caused by activities relating to the extraction and use of water resources and to seek mitigation of any existing or future adverse effects resulting from such activities.”

All alternatives in the HGLA draft EIS and Draft Plan Amendment are consistent with Inyo County's policy on the extraction and use of water.

1.6 ISSUES CONSIDERED BUT NOT ANALYZED FURTHER

1.6.1 Wilderness Inventory

All Public Lands within the CDD were analyzed and summarized in 1979 wilderness inventory decisions performed pursuant to FLPMA. See *“California Desert Conservation Area - Wilderness Inventory –Final Descriptive– March 31, 1979”*.

The wilderness inventory for the relevant portions of the three WIUs were maintained pursuant to section 201[a] of the FLPMA. Conditions existing in 2011 have not changed substantially since 1979. Mining activity and associated roads are even more extensive, and several new BLM authorized rights of way for new facilities have created additional impacts on the naturalness of the area. In summary, no changes have occurred since 1979 that would warrant reversal of the 1979 decision that wilderness characteristics were not present in the project area; therefore, wilderness characteristics will not be analyzed further. In reaching this conclusion BLM considered the following:

- The HGLA includes approximately 38 sections in four townships and contains geothermal applications CACA 043993, 043998, and 44082. Public Land in the HGLA overlaps CDCA Wilderness Original Inventory Units [hereafter WIU] #CDCA 131, 133, 157B, and several unnumbered WIUs along the Highway 395 corridor.
- WIU #CDCA 133 is entirely within T 21S R38E MDM and overlaps the southeast portion of the HGLA. The area is bounded by roads and on the south and east by the China Lake Naval Air Weapons Station [CLNAWS]. WIU 157B is west of Highway 395 and the eastern boundary is the railroad. The 1979 decisions were that the Public Land in these two WIUs was not of sufficient size

as to make practicable their preservation and use in an unimpaired condition. Also several unnumbered WIUs lie along the Highway 395 corridor. It was determined that they did not contain wilderness characteristics. The eastern boundaries of both WIUs 157 and 157A are the western aqueduct road, and as such, neither overlaps the project area.

- WIU #CDCA 132 is very large and extends almost 40 miles north to south. The northwestern boundary is Highway 190, the western is the access road for power lines along Highway 395, the eastern boundary, except for WIU 133, is CLNAWS, and the northeastern boundary are roads south of Highway 190. The Coso Range Wilderness was designated in 1994 and is in the northeast portion of the WIU. The portion of the WIU south of the Coso Range Wilderness has four distinct topographic components. From north to south they are: the southern half of Cactus and McCloud Flats, a mountain range on the east side of Haiwee Reservoir extending 12 miles southeast into CLNAWS, a southwest trending bajada from those mountains crossing Highway 395 and extending four miles north and south of Coso Junction, and a two mile wide triangular strip west of CLNAWS and east of the power line and Highway 395.
- The HGLA overlaps the southern end of the mountainous terrain and the bajada in the vicinity of Coso Junction. The 1979 analysis determined that the numerous mines in the mountainous area and associated roads and trails across the bajada and in the mountains were substantially noticeable imprints of man. As such, this portion of WIU #CDCA 132 was determined not to have wilderness character.

1.6.2 Executive Order No. 6206

Executive Order No. 6206 (EO 6206) was issued on July 1933, under authority of the Picket Act of 1910, to withdraw lands from “settlement, location, sale, or entry” ... “for the protection of the water supply of the City of Los Angeles.” Lands within the HGLA that are identified as withdrawn in EO 6206 include:

Mount Diablo Meridian,

T. 21 S., R. 37 E.,

sec. 11, Unserved Protracted Blocks 41 and 42, sec 14, lot 1 to 3, inclusive, 5 to 11, inclusive, NE1/4NE1/4, NE1/4NW1/4, W1/2SW1/4, SE1/4SW1/4, SE1/4SE1/4;

sec. 23, S1/2S1/2, Unserved Protracted Block 45 , 25, sec. 26, E1/2E1/2, sec. 35.

Mount Diablo Meridian,

T. 22 S., R. 37 E.,

sec. 1, All;

sec. 2, All;

sec. 11, All;

sec. 12, All;

Mount Diablo Meridian,

T. 21 S., R. 38 E.,

sec. 17, S1/2;

sec. 18, All;

sec. 19, All;

sec. 20, All;

sec. 21, All;

sec. 27, All;

sec. 28, All;

sec. 29, All;

sec. 30, All;

sec. 31 All;

sec. 32, All;

sec. 33 All,;

sec. 34, All;

Mount Diablo Meridian,

T. 22 S., R. 38 E.,

sec. 5, All;

sec. 6, All;

sec. 7, All;

sec. 8, All;

EO 6206, including subsequent amendments and applicable rulings, does not preclude geothermal leasing of these lands, nor any planned water use that is consistent with protecting the water supply of the City of Los Angeles.

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CHAPTER 2

ALTERNATIVES

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CHAPTER 2 ALTERNATIVES

2.1 INTRODUCTION

There are two decisions to be made on the basis of this National Environmental Policy Act (NEPA) analysis of the Bureau of Land Management's (BLM) Haiwee Geothermal Leasing Area (HGLA) geothermal exploration and development program. The first involves whether or not to amend the California Desert Conservation Area (CDCA) Plan, and if so, how it should be done. The second decision is whether or not to issue one or more of the three pending geothermal leases. These decisions are contingent upon evaluation of the HGLA as to its suitability for geothermal exploration and development. Following public input, nine general alternatives were developed and evaluated. The fully analyzed alternatives address decision outcomes that include amending the CDCA and issuing the leases. These alternatives are:

Fully analyzed alternatives:

- Alternative A:** Open the entire HGLA for geothermal exploration, development and leasing; amend the CDCA Plan to have the HGLA open and available for geothermal exploration, development and leasing; authorize all pending leases within the HGLA.
- Alternative B:** Close the entire HGLA to geothermal exploration, development and leasing; amend the CDCA Plan to have the HGLA closed and unavailable for geothermal exploration, development and leasing; deny authorization of all pending leases within the HGLA.
- Alternative C:** Open the HGLA to geothermal exploration, development and leasing; with no surface occupancy (NSO) allowed in sensitive areas; amend the CDCA Plan to have the HGLA open and available for geothermal leasing; authorize all pending leases within the HGLA. (Preferred Alternative)
- Alternative D:** Selective closure of sensitive resource areas within the HGLA for geothermal exploration and development; amend the CDCA Plan to have designated areas within the HGLA open and available for geothermal leasing; amend the CDCA Plan to have designated areas within the HGLA closed and unavailable for geothermal leasing; authorize all pending leases within the HGLA.

Alternative E: No action; the area would remain under current management as specified in the CDCA Plan; deny authorization of all pending leases within the HGLA.

Alternatives considered but not fully analyzed (also see section 2.4):

- Alternative Technologies for Power Generation
- Energy Conservation and Demand Side Management
- Alternative Geothermal Technologies
- Alternative Sites

This chapter evaluates each alternative's potential to meet the BLM's purpose and need for the HGLA. The alternatives were developed in response to the issues, concerns, and opportunities identified at public scoping meetings, in collaboration with interested agencies, organizations, and stakeholders, and in evaluations between BLM interdisciplinary resource specialists. Figure 2.1-1 *Land Status* provides additional context for understanding the alternatives being proposed.

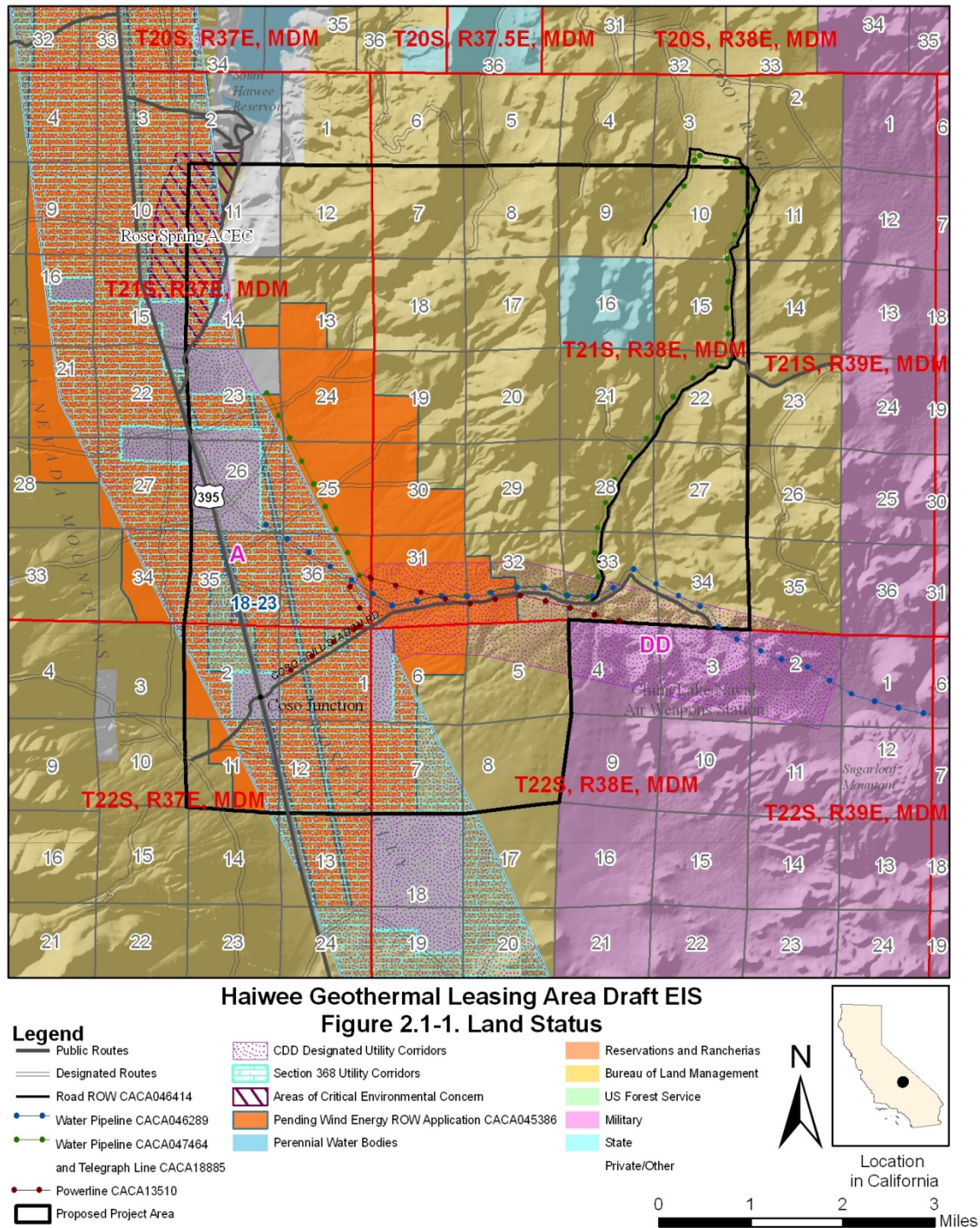
Following the discussion of the fully analyzed alternatives, the alternatives considered but eliminated are discussed. Four alternatives were considered but eliminated from full analysis because they do not meet the purpose of and need for action.

This chapter also contains a detailed discussion of the Reasonably Foreseeable Development (RFD) scenario developed by the BLM. The RFD is used in Chapter 4 as a basis to identify potential impacts associated with each of the action alternatives (A, B, C, or D).

Three alternatives open the HGLA to geothermal leasing and development (A, C, and D). Alternative B closes the HGLA to leasing and development. The No Action Alternative (E) is required under the National Environmental Policy Act (NEPA) and implementing Council of Environmental Quality (CEQ) regulations (40 CFR 1500-1508).

Alternatives A, C, and D share many common elements. To different degrees, all would result in finding some portion of the HGLA suitable for geothermal exploration and development, and requirements such as protection of Mojave ground squirrel and desert tortoise habitat would apply. The RFD scenario is the same for alternatives A, C and D. Other resource protection measures, including the stipulations and best management practices (BMPs) described in this chapter, also apply to alternatives A, C, and D.

FIGURE 2.2-1 Land Status



2.2 GEOTHERMAL GENERATION FACILITY DESCRIPTION: REASONABLY FORESEEABLE DEVELOPMENT (RFD) SCENARIO

The following section describes on-the-ground activities for each phase of reasonably foreseeable geothermal power development. As discussed in Chapter 1, the issuance of geothermal leases confers on the lessee a restricted or limited right to exploration and development of geothermal resources within the lease area. Ground-disturbing activities are not authorized by the issuance of federal geothermal leases. If leasing is authorized, the BLM will conduct additional site and project specific environmental analysis to determine any additional conditions that may be required to facilitate further project specific exploration, development, and utilization of geothermal resources. Any exploration or development authorization shall include appropriate site and project specific conditions of approval.

2.2.1 Background

Twenty-four of the 38 sections in the HGLA boundaries are within the Coso Known Geothermal Resource Area (KGRA). Figure 2.2-1 illustrates the spatial relationship between these two areas and the development at the Coso geothermal field. HGLA lands that are outside of the KGRA are strikingly similar in geology to lands within the KGRA and have similar mineralogy, lithology, and structure. Numerous technical papers and geologic analyses have documented the similarities in geologic setting between the two areas.¹ While there is no direct data available to validate this RFD scenario, the proximity to the Coso geothermal operations and the KGRA suggests the possibility of a similar resource within the HGLA. The RFD is largely based on the HGLA being in the vicinity of the active Coso geothermal field and the ongoing operations that occur there.

The Coso geothermal field has produced as much as 273 megawatts (MW) of electricity since construction. This field currently produces less than that initial maximum from a total of nine 30 MW geothermal turbine/generators. The geothermal system is hot water dominated so a “dual flash” process is used to convert the heat energy into steam to drive the turbines. The choice of technology is largely controlled by the temperature of the produced water. Other technologies include the direct use of dry steam and binary systems where the geothermal fluid heats a secondary fluid for power generation. The Coso field is located in an area of relatively recent volcanic activity which resulted from magma intruding to shallow depths along localized structural controls such as faults, thereby providing a heat source for the geothermal field.

¹Duffield, et al., 1980, Jackson & O'Donnell, 1980, Wohletz and Heiken, 1992, etc.

The Coso geothermal field is used as an analog for what may be found in the HGLA. Unlike Coso, there is an absence in the HGLA, of surface features associated with geothermal activity such as hot springs and fumaroles. Based on this observation, it is assumed that any resource, should one be located, would be deeper than at Coso and less economically viable. Therefore the RFD assumes that only two 30 MW “dual flash” power plants would be constructed with a useful life of 30 years. The foreseeable development described could occur on any land in the HGLA regardless of surface or mineral ownership.

2.2.2 Exploration Activities

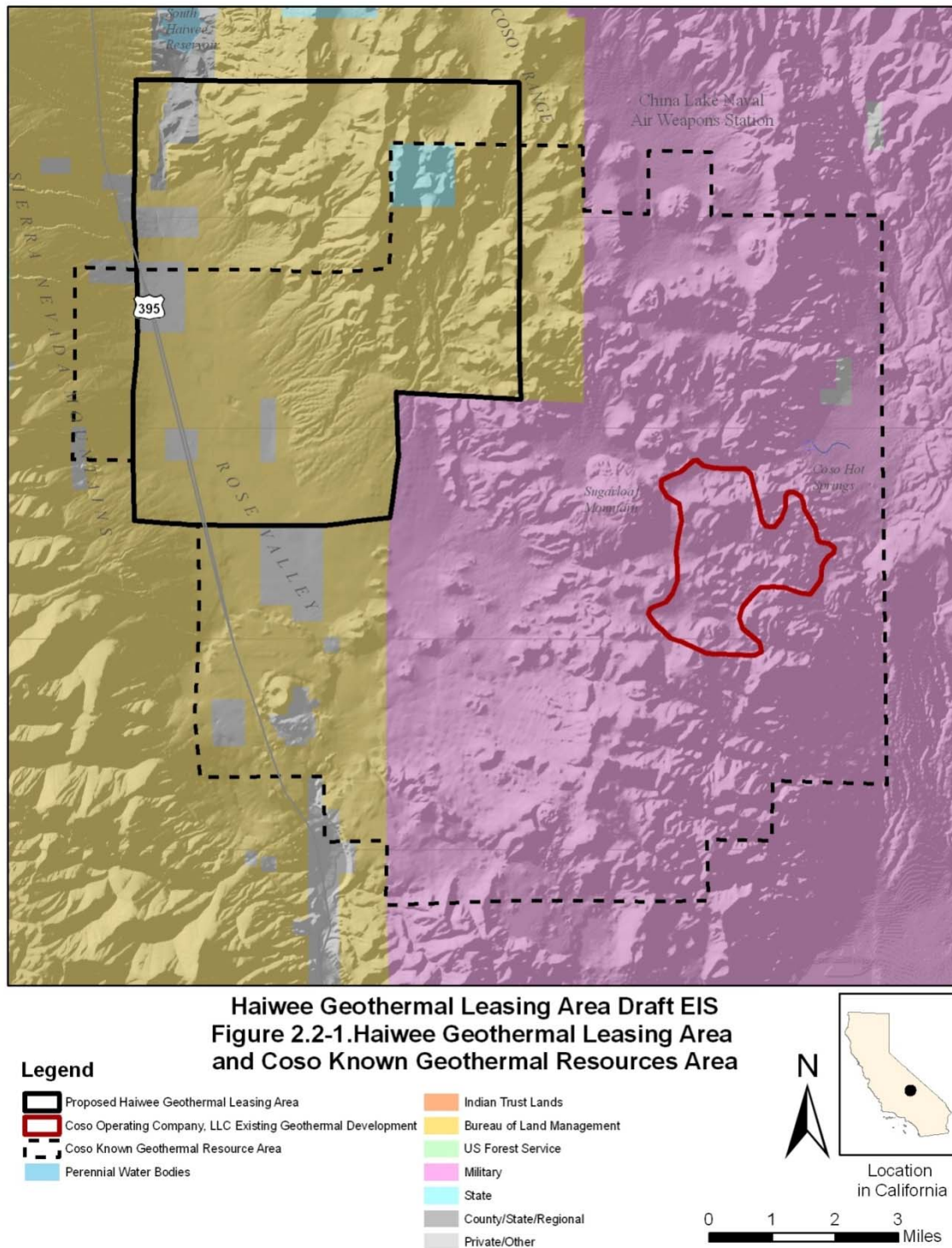
For exploration activities within an area open to geothermal leasing, an operator must file an exploration application with the BLM that identifies the areas to be explored and the method of exploration. The proposal identified in the application undergoes NEPA and other appropriate environmental review. The BLM may, depending upon the results of the analysis undertaken during this review, approve, reject, or modify the project requested in the application.

Exploration is expected to include some geophysical exploration such as seismic reflection / refraction testing², and other forms of (low impact) surface geophysical testing. Up to 20 temporary exploration, or temperature gradient wells (TGW), could also be expected with full development of this RFD.

Geophysical testing can be passive, measuring naturally-occurring events to define subsurface features, or it can involve the observation of artificially induced events. Induced events are created using such tools as mechanical vibrators, called vibroseis, small explosive charges, or electrical generators. Testing typically requires measurement of seismic waves, magnetic fields, or electrical current using receivers stationed at known locations. The size and intensity of the energy measured as it moves through the earth provides a clearer understanding of the subsurface. Geophysical testing is expected to create two acres of total surface disturbance in the RFD scenario.

²<http://www.geophysics.co.uk/mets3.html>

FIGURE 2.2-1 The Haiwee Geothermal Leasing Area (HGLA) and the Coso Known Geothermal Resources Area (KGRA)



TGWs are small diameter, relatively shallow boreholes that do not extend into a geothermal resource or reservoir. The purpose of these wells is to identify areas that have the greatest amount of heat flow. Once identified, these areas could be the targets for additional (slim-hole) exploration wells. It is assumed that the surface disturbance for each of the 20 exploration wells, or TGWs, is three acres. The three acres of disturbance includes a drilling site and an access road. It is likely that some of the drilling locations used for the TGWs may also be used for production well locations. For the purposes of the RFD, however, it was assumed that these would remain separate disturbances.

The total surface disturbance anticipated from exploration is 62 acres. It is assumed that this would be a temporary impact, since the exploration and TGWs will typically be plugged, abandoned, and these well sites, along with the two acres disturbed by geophysical testing, would be reclaimed. If a resource is identified, however, it is understood that, for a period of time, some of the TGWs may be used for observation or monitoring.

2.2.3 Construction Activities

Power plant development is not considered a reasonable foreseeable future activity when analyzing the effects of a geothermal exploration project proposing solely TGWs, flow testing, and limited geophysical testing. For the purpose of this RFD scenario, however, the development phase will occur if an operator locates a viable geothermal reservoir during the exploration phase.

An Operations Plan would be required for drilling of production and injection wells as part of the Geothermal Drilling Permit. A Plan of Development is associated with Unitization and submitted with the Unit Agreement. This operations plan would state how the operator would develop, operate, maintain and decommission a geothermal plant. The plan of development will include a complete description of the construction, operation, and maintenance of infrastructure to capture or harness the geothermal resource; construction of a power plant and installation of transmission lines to distribute generated power; construction of access roads that are able to handle the large-scale equipment used to construct and maintain the facility; and reclamation activities planned after the useful life of the facility. In order to use federal land to produce geothermal power, a Utilization Plan, a Facility Construction Permit, and a Site License must be submitted and approved by BLM. Before commercial operations can begin, a Commercial Use Permit must also be submitted to the BLM and approved.

Each BLM approval of a plan, or permit, requires NEPA and other appropriate environmental review, specific to the newly proposed actions. This further review would evaluate the possible environmental impacts and support decision making by the BLM. The BLM may approve, reject, or modify the proposed project based on the analysis performed during the review. Construction, operation, development, and reclamation activities may

impact the environment due to project-related activities. Defining each project's specific boundaries, capacity, and other limitations would occur with the NEPA analysis and subsequent ROW decision for the development application.

2.2.4 Reasonably Foreseeable Development (RFD) Scenario

The BLM has prepared the RFD scenario as a basis for analyzing environmental impacts that have the potential to occur if one of the action alternatives is selected. As the name implies, the level and type of development anticipated in the RFD is a reasonable projection of what could eventually occur if the HGLA is opened to geothermal leasing. It was not intended to be a “maximum-development” scenario; however it is biased towards the higher end of expected development in order to ensure all adverse impacts are identified.

The total surface disturbance to be analyzed within the HGLA as a result of various exploration and construction activities is 384 acres. This total includes 62 acres of temporary disturbance from exploration activities, 202 acres from wells and pipelines, and an additional 120 acres for power plants and transmission. As indicated in the RFD, the total disturbed acreage following restoration of the temporary use areas is approximately 276 acres. The 276 acre footprint represents the maximum potential disturbance that has been analyzed for the operational phase of the geothermal production facilities. Additional surface use restrictions, such as a No Surface Occupancy (NSO) lease stipulation, could result in far fewer surface impacts than have been analyzed.

The HGLA encompasses about 38 sections, or approximately 24,574 acres (including all public and private). Of this, most of the land is BLM-managed surface and subsurface. Of the 24,574 acre leasing area, only about 2,000 acres are non-federal (including one section of California State lands), for a total federal surface land area of about 22,805 acres. Included in the 22,805 acres of BLM-managed lands are the areas subject to the three pending lease applications covering approximately 4,500 acres.

The RFD uses a simple ratio of 93% (22,805 acres BLM/24,574 acres Total) for the number of acres of BLM managed land that could be open to development. That is to say, only 93% of the RFD scenario and impact would be expected to occur on federal lands.

2.2.5 Structures and Facilities

To support each of the two 30 MW geothermal power generation facilities, 15 production wells and seven injection wells would need to be drilled over the course of the estimated 30 year useful life of each power plant. This includes both wells drilled initially, and makeup or replacement wells. For the purposes of this analysis, it is anticipated that five initial

production wells will be drilled upon startup and one new production well will be drilled every three years. The initial and replacement wells would be located on up to five new well pads, with each pad large enough to accommodate the drilling of up to five wells. All wells on BLM-managed land will be permitted by the BLM using standard review methods that ensure: 1) protection of ground water; 2) protection of public safety; and 3) that the environment and other valuable resources are not negatively impacted.

Each well has the potential to be from 6,000 feet to 15,000 feet deep. However, these depths should not be considered a limiting factor, since the potential environmental effects are not strongly correlated to the depth of a well, or to the number of wells on a well pad. For example, a 15,000-foot well could be drilled with only slightly more impacts than a 6,000 foot well. The RFD considers the level of impacts associated with the deeper wells, providing a high-development bias, thus eliminating the need to analyze the shallower example. Surface impacts could be further minimized by requiring that multiple wells be drilled from existing single well pad locations. In the case of leases with NSO stipulations, wells would need to be directionally drilled from adjacent lands located outside the area, possibly with additional restrictions to ensure that surface impacts do not occur.

Because the geothermal resource in the HGLA is expected to be relatively deep, directional drilling could be practical and could result in drilling locations that could accommodate multiple wells. In this case, each well pad would require approximately seven acres including cut and fill. As the topography is quite steep in parts of the HGLA, the extent of cut and fill could be important.

Given the rugged topography, each well pad is estimated to need three miles of 30 foot wide access road and one mile of pipeline. It is estimated that half the pipelines will follow the access roads in flatter areas, thereby adding 10 feet to the total width. It is estimated that the other half of the pipelines will be built in rugged areas and would go “cross country”. These pipelines would require 30 feet of disturbance initially, but after construction, only a 15-foot access road will remain. Those disturbed acres not used for pipeline access road would be reclaimed to restore native vegetation.

The total foreseeable surface disturbance expected for *each* of the two 30 MW power plants is detailed in Table 2-1. This estimate includes all new well pads, roads, and pipeline corridors associated with the well field needed to supply geothermal resources for *one* 30-MW power plant. The expected disturbance would double should two 30-MW power plants be built: 202 acres of temporary disturbance (101 acres x 2 power plants) and then about 194 acres of disturbance (97 acres x 2 power plants) following initial reclamation.

Table 2-1 Approximate Surface Disturbance Associated with Development of New Geothermal Wells for One 30-MW Power Plant

Description	Unit Surface Disturbance (acres)	Number	Total Surface Disturbance (acres)
Well locations	7	5	35
Access roads	3.6 acres/mi	15 miles	54
Flat-land Pipelines	1.2 acres/mi	2.5 miles	3
Rugged-land Pipelines (temporary)	3.6 acres/mi	2.5 miles	9
Rugged-land Pipelines (permanent)	1.8 acres/mi	2.5 miles	5
Total:			101 (temporary) 97 (permanent)

Each well is expected to take between 90 and 150 days to drill. During this time, high levels of noise could be generated by the diesel engines that power the drilling rigs and air compressors/mud pumps, as well as from the drawworks, drawworks brake, racking of pipe, and well testing. The racking of pipe and drawworks brake are higher pitched noises that typically travel further than sources such as diesel engines. To limit the undesirable effects of light and noise on wildlife, drilling rigs may be required, if analysis warrants, to implement best management practices that are commonly employed in more urban settings. All diesel engines will use mufflers per standard industry practice. All well testing would be done through mufflers to reduce noise. Up to three drilling rigs could be in operation simultaneously and drilling is expected to take place 24 hours a day, seven days per week.

2.2.6 Operations and Maintenance

The Haiwee RFD has assumed that two dual-flash power plants might be constructed to generate steam and electricity on any leases that might be issued within the HGLA. These two plants would be operated and maintained for the duration of the 30-year lease, with a preferential right to renew the license under typical BLM terms and conditions. The RFD scenario for the HGLA anticipated that Dual-flash technology would be used since the nearby Coso geothermal operations are run in that way. That does not preclude a binary process from being the technology of choice. A binary process might be preferable if a resource was identified that had more moderate water temperatures than those currently found in production wells at Coso. The level of surface disturbance is roughly equivalent for both dual-flash and binary technologies. The principal difference between them is that

binary systems use relatively less water than dual-flash systems. Other types of geothermal systems are not expected to be identified in this area, and thus were not analyzed.

Each plant location would require about 20 acres, which when added to surface disturbance associated with the well pad would be approximately 25 acres of total surface disturbance including cut and fill. Each plant would also require three miles of access road and four miles of new transmission line to intertie with an existing transmission line that runs through the southwest portion of the HGLA. It is assumed that the access road would require 30 feet of surface disturbance, which includes cut and fill. Transmission intertie lines require 100 feet of temporary surface disturbance; however, once the lines are constructed all but a 20 foot access road would be restored with native vegetation.

The total surface disturbance expected to be required for both power plants is detailed in Table 2-2.

Table 2-2 Approximate Surface Disturbance Associated with the Haiwee Power Plant Developments

Description	Unit Surface Disturbance (acres)	Number	Total Surface Disturbance (acres)
Power plant location	25 acres/power plant	2 power plants	50
Access roads	3.6 acres/mi	6 miles	22
Transmission lines – temporary	12.1 acres/mi	4 miles	48
Transmission lines – permanent	2.4 acres/mi	4 miles	10
			120 (temporary)
Total Disturbed Acres – Power Plants:			82 (permanent)

2.2.7 Decommissioning and Reclamation

Temporary total disturbance from exploration, development, and operation of two 30 MW geothermal electrical generating facilities is projected to be 384 acres (see discussion above). 353 of these acres (92%) are expected to occur on BLM managed lands. Following initial exploration and development, 108 acres of disturbance is projected to be reclaimed to native conditions. For the 30-year operational life of the facilities, the projected long term

disturbance is 276 acres. Of that, 254 acres (92% of 276 acres) is expected to occur on BLM managed lands.

The decommissioning of a facility typically occurs when the energy resource has been depleted. Close-out entails the removal of all hardware and infrastructure improvements that serviced the facility (i.e., roads, concrete pads, and structures) and the rehabilitation of the land in accordance with the reclamation plan approved by the BLM. The goal of the completed reclamation is to return the land to its pre-project condition.

2.3 ALTERNATIVES

2.3.1 Alternative A: Open the entire HGLA for geothermal exploration, development and leasing; amend the CDCA Plan to have the HGLA open and available for geothermal exploration, development and leasing; authorize all pending leases within the HGLA.

All BLM administered public lands within the proposed HGLA would be identified as open and available for geothermal exploration, development, and leasing under this alternative. (See Figure 2.3.1-1 Alternative A – Environmental View and Figure 2.3.1-2 Alternative A – Land Status View.)

The three pending geothermal leases located within the HGLA would be authorized, CACA-043998, CACA-044082, and CACA-043993. Approval of a site specific exploration work plan would be required before any ground-disturbing activities could occur.

The CDCA Plan would be amended to classify all land within the HGLA as open and available for geothermal exploration, development, and leasing.

Groundwater extraction for consumptive use during exploration, development, and project operations activities may be allowed for some leasing applications, to the extent that groundwater use, in combination with all other authorized groundwater uses, does not exceed the safe yield or recharge rate to the Rose Valley Aquifer, and does not cause a decline of 10% or more to the average annual fluctuation of water flowing into the surface features at Little Lake, when combined with all other uses that have been approved within the Rose Valley. Special Administrative Stipulation SA-HGLA-10 (see Section 2.6 below), protecting water resources, will be attached to any geothermal leases that would be issued within the HGLA with items SA-HGLA-10a), SA-HGLA-10b), and SA-HGLA-10c) lined out,

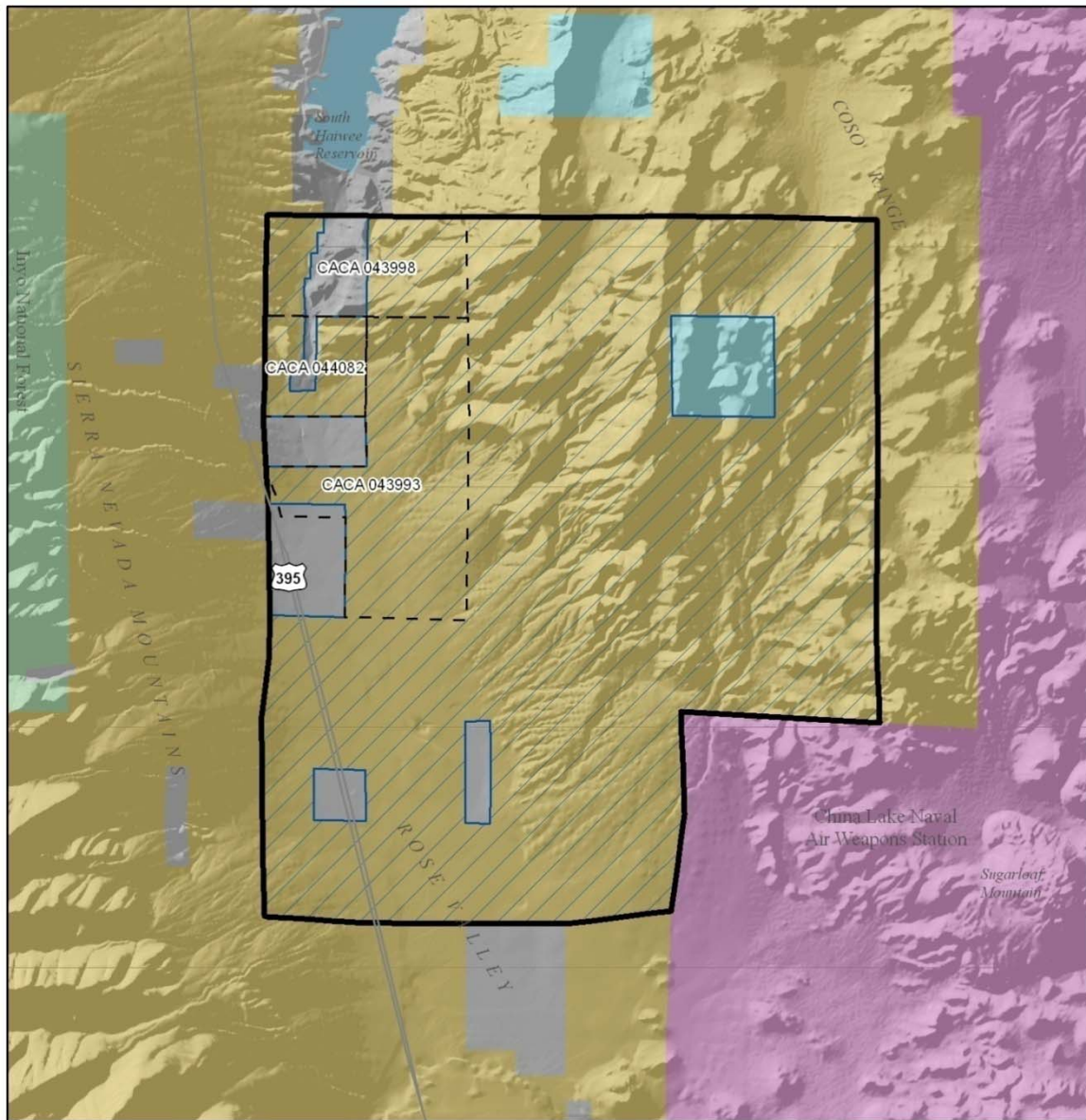
removed, and not in effect. Groundwater extraction for consumptive use may have other requirements or restrictions to be determined on a project or activity-specific basis.

Should a geothermal resource be identified within the HGLA, compulsory unitization will be expected. Unitization provides for the exploration and development of an entire geologic structure or area by a single operator so that drilling and production may proceed in the most efficient and economic manner. (See BLM Handbook H-3180-1) This would be applied to the entire HGLA, or an appropriate portion, for the purpose of minimizing impacts to the area.

No changes in OHV route designations will be made under this alternative. However, if the BLM receives proposals for exploration or development, changes in route designations may be proposed. Such proposed project specific changes would be analyzed in a subsequent environmental document (EA or EIS) prepared for the proposed exploration or development project. Thus, such changes to route designations, if authorized within the HGLA, may be made without further plan amendment.

Applicable lease stipulations, mitigation measures, and best management practices are detailed in Section 2.6 below.

FIGURE 2.3.1-1 Alternative A



**Haiwee Geothermal Leasing Area Draft EIS
Figure 2.3.1-1. Alternative A**

Legend

- | | |
|---|---------------------------|
| Proposed Haiwee Geothermal Leasing Area | Bureau of Land Management |
| Pending Geothermal Lease Applications | US Forest Service |
| Proposed Open to Geothermal Development | Military |
| Perennial Water Bodies | State |
| | County/State/Regional |
| | Private/Other |



Location
in California

0 1 2 3
Miles

2.3.2 Alternative B: Close the entire HGLA to geothermal exploration, development and leasing; amend the CDCA Plan to have the HGLA closed and unavailable for geothermal exploration, development and leasing; deny authorization of all pending leases within the HGLA.

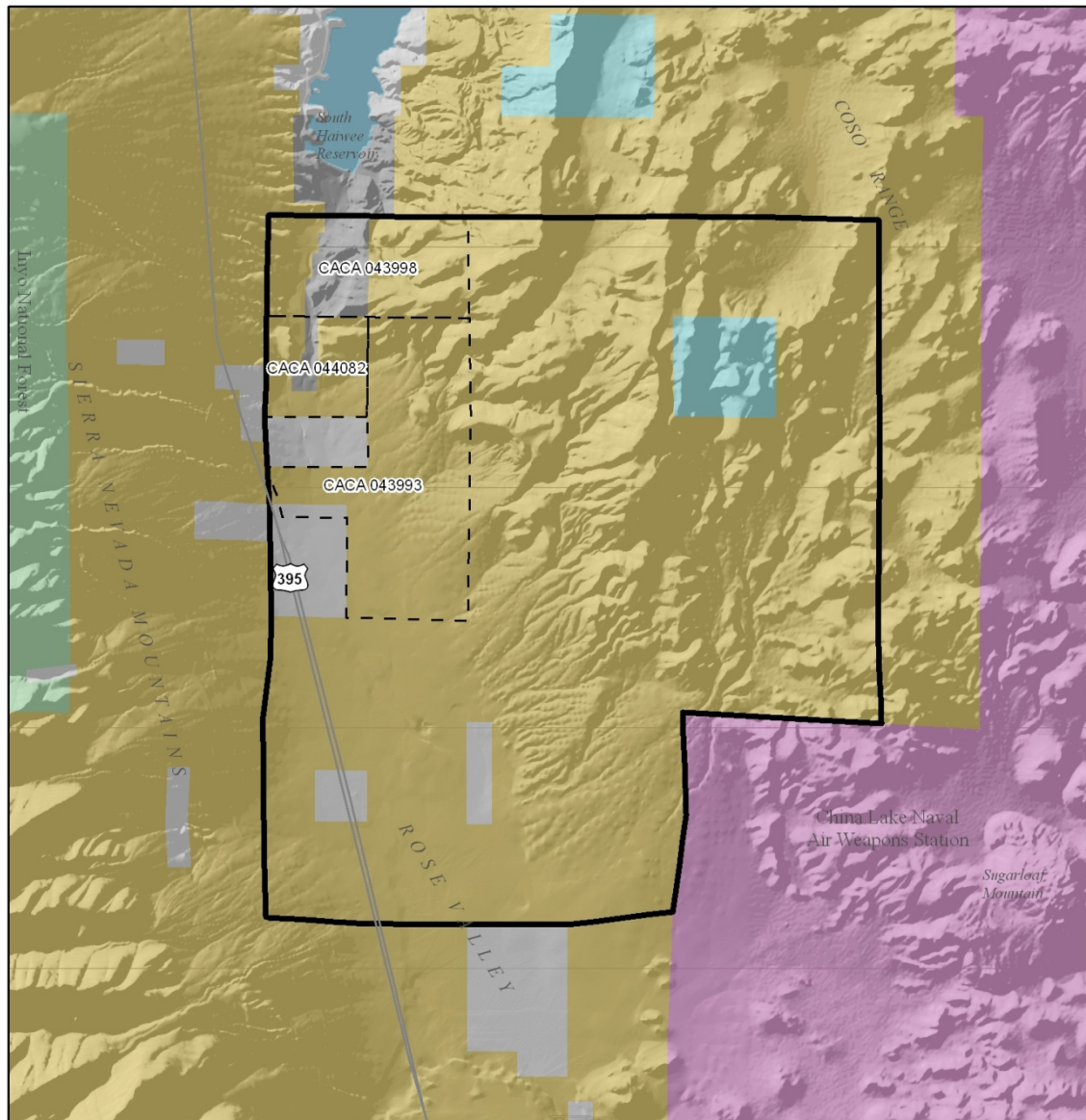
The CDCA Plan would be amended to close the land within the HGLA to geothermal exploration, development, and leasing under this alternative.

BLM administered public lands located within the HGLA would be identified as closed and unavailable to geothermal exploration, development, and leasing.

Therefore, the pending geothermal lease applications, CACA-043998, CACA-044082, and CACA-043993, would be denied.

Alternative B would not affect any OHV route designations.

FIGURE 2.3.2 Alternative B



Haiwee Geothermal Leasing Area Draft EIS
Figure 2.3.2-1. Alternative B

Legend

- | | |
|---|---------------------------|
| Proposed Haiwee Geothermal Leasing Area: Closed to Geothermal Development | Bureau of Land Management |
| Pending Geothermal Lease Applications | US Forest Service |
| Perennial Water Bodies | Military |
| | State |
| | County/State/Regional |
| | Private/Other |



Location
in California

0 1 2 3
Miles

2.3.3 Alternative C: Open the HGLA to geothermal exploration, development and leasing; with no surface occupancy (NSO) allowed in sensitive areas; amend the CDCA Plan to have the HGLA open and available for geothermal leasing; authorize all pending leases within the HGLA. (Preferred Alternative)

All BLM administered public lands within the proposed HGLA would be identified as open and available for geothermal exploration, development, and leasing under this alternative. (See Figure 2.3.3-1 Alternative C – Environmental View and Figure 2.3.3-2 Alternative C – Land Status View.) Specific acreage within the HGLA would be identified as available for geothermal exploration, development, and leasing, but subject to restrictions to protect sensitive resources. The sensitive resources area is largely expressed by the recognized Mojave ground squirrel core habitat, including its overlay of the Rose Springs ACEC, and is shown on Figure 2.3.3-1 Alternative C – *Haiwee Geothermal Leasing Area – Alternative C, Environmental View*. Resources protected by this restriction include the Mojave Ground Squirrel, the Desert Tortoise, cultural resources, historical resources, and groundwater. This area is expressly defined by the geospatial data file represented in map Figure 2.3.3-1. Any geothermal leases that would be issued within the defined sensitive resources area would include the NSO stipulation NSO-HGLA-1 (see Section 2.6 below). All of the HGLA located outside of the sensitive resources area would be identified as open and available for geothermal exploration, development, and leasing under standard terms and conditions, and including the appropriate lease stipulations from Section 2.6 below.

The three pending geothermal leases located within the HGLA would be authorized: CACA-043998, CACA-044082, and CACA-043993. Approval of a site-specific exploration or development plan would be required before any ground disturbing activities could occur. All surface disturbing activities will be prohibited in areas that are located within the defined sensitive resource area unless they have been authorized by a previous action.

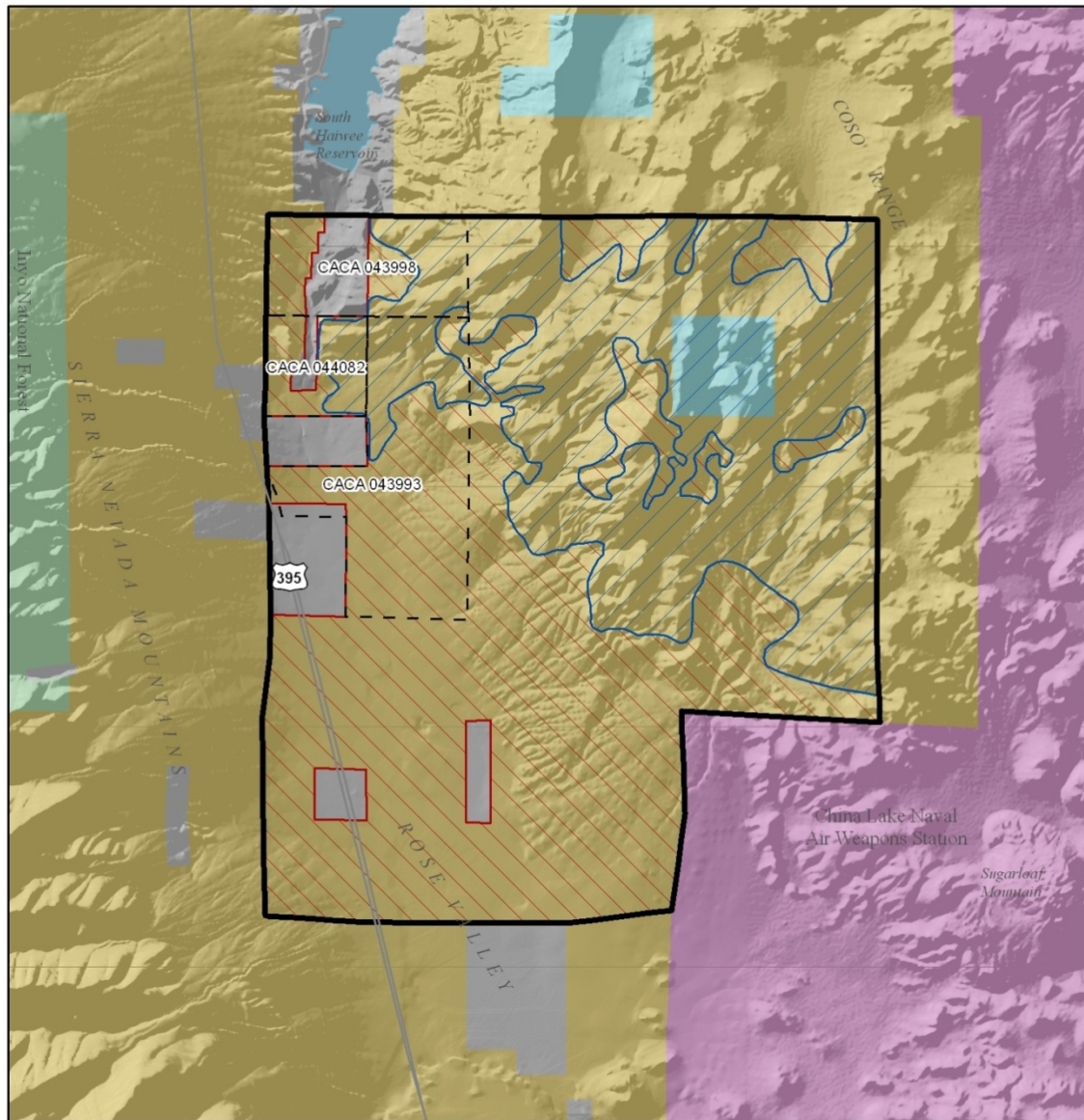
Groundwater extraction for consumptive use will be prohibited or strictly controlled throughout the entire HGLA under Alternative C. Special Administrative Stipulation SA-HGLA-10 (see Section 2.6 below), protecting water resources, will be attached to any geothermal leases that would be issued within the HGLA with item SA-HGLA-10d) lined out, removed, and not in effect.

The CDCA Plan would be amended to find all land within the HGLA as suitable for geothermal exploration, development, and leasing, with the requirement that any geothermal lease issued subsequent to the Final Record of Decision, include Stipulation NSO-HGLA-1 protecting the defined sensitive resources area.

No changes in OHV route designations will be made under this alternative. However, if BLM receives proposals for exploration or development, changes in route designations may be proposed. Such proposed changes would be analyzed in a subsequent environmental document (EA or EIS) prepared for the proposed site specific exploration or development project. Thus, such changes to route designations, if authorized within the HGLA, may be made without further plan amendment.

Applicable lease stipulations, mitigation measures, and best management practices are detailed in Section 2.6 below.

FIGURE 2.3.3-1 Alternative C



**Haiwee Geothermal Leasing Area Draft EIS
Figure 2.3.3-1. Alternative C - Preferred Alternative**

Legend

- | | |
|---|---------------------------|
| Proposed Haiwee Geothermal Leasing Area | Bureau of Land Management |
| Pending Geothermal Lease Applications | US Forest Service |
| Proposed Open to Geothermal Development | Military |
| Sensitive Resources Area: Proposed No Surface Occupancy | State |
| Perennial Water Bodies | County/State/Regional |
| | Private/Other |



Location
in California

0 1 2 3
Miles

2.3.4 Alternative D: Selective closure of sensitive resource areas within the HGLA for geothermal exploration and development; amend the CDCA Plan to have designated areas within the HGLA open and available for geothermal leasing; amend the CDCA Plan to have designated areas within the HGLA closed and unavailable for geothermal leasing; authorize all pending leases within the HGLA.

Specific acreage within the HGLA would be identified as open and available for geothermal exploration, development, and leasing. Other, separate areas within the HGLA would be identified as closed and unavailable for geothermal exploration, development, and leasing in order to protect sensitive resources. The sensitive resource area is largely expressed by the Mojave ground squirrel core habitat, including its overlay of the Rose Springs ACEC, and is shown on Figure 2.3.3-1 – *Alternative D*. This area is expressly defined by the geospatial data file represented in map Figure 2.3.4-1. The area of the HGLA outside of the sensitive resource area would be identified as open and available for geothermal exploration, development, and leasing with surface occupancy. (See Figure 2.3.3-1 – *Alternative D*)

The three pending geothermal leases located within the HGLA would be approved, with modifications so that leases issued would include only lands that are outside of the defined sensitive resources area. The modified pending geothermal leases, CACA-043998, CACA-044082, and CACA-043993 would be approved and authorized. Approval of a site specific exploration or development plan would be required before any ground disturbing activities could occur. To clarify, no lands within the defined sensitive resources area would be authorized for exploration, development, or leasing.

Groundwater extraction for consumptive use will be prohibited or strictly controlled throughout the entire HGLA under Alternative D. Special Administrative Stipulation SA-HGLA-10 (see Section 2.6 below), protecting water resources, will be attached to any geothermal leases that would be issued within the HGLA with item SA-HGLA-10d) lined out, removed, and not in effect.

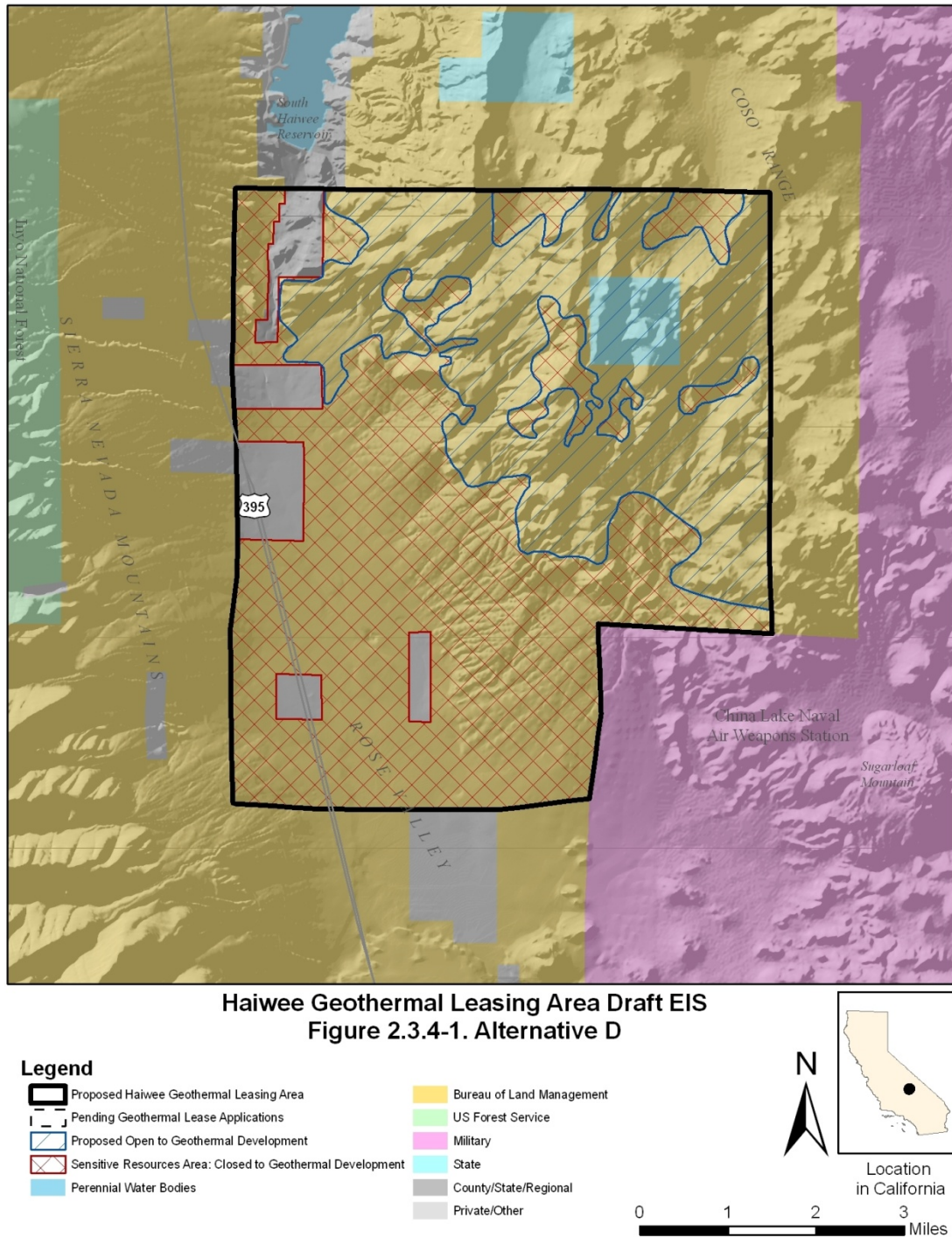
The CDCA Plan would be amended to identify the sensitive resource area within the HGLA as closed and unavailable to geothermal exploration, development, and leasing. The CDCA Plan would also be amended to classify that land within the HGLA and outside of the defined sensitive resources area as suitable for geothermal exploration, development, and leasing.

No changes in OHV route designations will be made under this alternative. However, if BLM receives proposals for exploration or development, changes in route designations may be proposed. Such proposed changes would be analyzed in a subsequent environmental

document (EA or EIS) prepared for the proposed site specific exploration or development project. Thus, such changes to route designations, if authorized within the HGLA, may be made without further plan amendment.

Applicable lease stipulations, mitigation measures, and best management practices are detailed in Section 2.6 below.

FIGURE 2.3.4-1 Alternative D



2.3.5 Alternative E: No Action; the area would remain under current management as specified in the CDCA Plan; deny authorization of all pending leases within the HGLA.

This alternative would not change the current management of the BLM administered public lands within the HGLA. This land would remain unclassified in regards to geothermal exploration, development, and leasing. The CDCA Plan would not be amended, and the existing plan decisions, stipulations, and allocations would not change as a direct result of this planning process.

Under Alternative E, all individual applications for geothermal exploration, development, and leasing on lands within the HGLA, including those pending applications, CACA-043998, CACA-044082, and CACA-043993, would be denied. Such denial in this decision-making process would not preclude future consideration of lease issuance in this area.

The No Action alternative would not change any OHV route designations, and would not affect the process for changing route designations in the future.

The No Action Alternative was analyzed to provide a baseline from which to evaluate the other action alternatives in accordance with NEPA and the CEQ regulations (40 CFR 1500-1508).

2.4 ALTERNATIVES CONSIDERED BUT ELIMINATED

2.4.1 Alternative Technologies for Power Generation

The BLM has evaluated a number of alternative generation sources, both renewable and fossil-fuel generation, as alternatives to leasing the HGLA for geothermal exploration and possible development. These other generation sources include:

- Solar
 - Solar Thermal
 - Photo Voltaic
 - Distributed Solar
- Wind
- Hydroelectric
- Tidal
- Wave
- Solid Waste

- Biofuels
- Fossil Fuel
 - Coal-Fired
 - Natural Gas
 - Nuclear

Many solar and wind developments are currently proposed throughout the region, and BLM is evaluating the viability of these projects through their application review process and environmental review under NEPA. The HGLA has potential for such developments, and any developments will be evaluated through the BLM's processes once an application for the geographic area is received. Evaluating solar and wind energy was not within the purpose of and need for this action.

Hydroelectric power generation has been developed throughout the western U.S. in viable locations for many decades. The HGLA does not appear to contain adequate resources to develop hydroelectric energy. Tidal and wave generation are also not applicable to the HGLA. Since the sources are not present, these types of generation were not further evaluated.

Solid waste and biofuels are technologies for power generation that are considered viable. BLM may consider this type of energy production in the HGLA if an application is received. Development of these technologies would not meet the purpose of and need for this action, and are therefore eliminated from further consideration.

No coal plants are currently being considered as viable options in California or in most of the western U.S. Gas-fired generation, including simple cycle generation and combined cycle generation, and nuclear power are all viable technologies, however, BLM has not received an application for these technologies within the project area.

The need for action is to allocate specific lands in the HGLA as closed, open, or open with constraints to geothermal leasing (see Alternatives in Figure 2.3.1-1, Figure 2.3.2-1, Figure 2.3.3-1, and Figure 2.3.4-1). All of the technologies discussed above are eliminated from further consideration because they do not meet the need for action. However, if BLM did receive an application for any of these technologies, BLM would further evaluate the proposal under separate NEPA documentation.

2.4.2 Energy Conservation and Demand Side Management

Energy conservation is the more efficient use of electricity by customers. Conservation incentive programs are designed to reduce energy consumption per customer, providing an

increase in energy resources for new loads. Load management refers to power supply system improvements by a utility. Load management programs allow customer demand to be moved away from peak load hours, freeing existing resources to serve additional peak loads. These resources are the first used to meet customer electricity demands before constructing new power plants or transmission lines.

Energy conservation and load management programs have the advantage of reducing energy consumption without any documented environmental impacts. They have also lowered utility forecasts of electric energy sales and system peak demand. Each utility has its own programs for energy conservation and demand side management, but typically include weatherization programs, efficient lighting, irrigation retrofitting, electrical generation efficiency improvements, appliance replacement programs, commercial and industrial load management, streetlight conversion, voltage reductions, meter conversions and upgrades, to existing appliances such as water heaters.

Though energy conservation and load management can somewhat reduce energy consumption, they affect energy use and system reliability on a local rather than a regional basis. Therefore, energy conservation and demand side management cannot be considered an alternative action to meet the stated purpose of and need for the proposed leasing action. For this reason energy conservation plans were eliminated from further consideration.

2.4.3 Alternative Geothermal Technologies

The determination for size and type of geothermal generating plant design is based on the geothermal resource characteristics—temperature, pressure, volumes of fluid produced, and chemical properties of the geothermal reservoir. The Haiwee RFD is based on a dual flash geothermal generating plant design utilizing wet cooling towers for steam condensation. This design is based on the assumption that the anticipated temperatures of the Haiwee geothermal resources are comparable to those of the Coso Known Geothermal Resource Area (KGRA), located approximately three miles to the southeast and with similar geologic formations. The Coso geothermal generating facilities employ dual flash plant designs with wet cooling towers. As an alternative, the BLM also evaluated a number of other plant design options such as binary and dry steam plants as well as dry cooling towers. The dry steam power plant was eliminated, because the dry steam reservoirs are rare and not anticipated to occur in the leasing area.

2.4.3.1 Binary Plant

A binary geothermal power plant utilizes comparatively low-temperature (190 to 330 degrees Fahrenheit) hydrothermal resources. The geothermal fluid (which can be either hot water,

steam, or a mixture of the two) heats a “working fluid” (such as isopentane or isobutene) that boils at a lower temperature than water. The two liquids are kept completely separate through the use of a heat exchanger, which transfers the heat energy from the geothermal water to the working fluid. When heated, the working fluid vaporizes into gas, and like steam, the force of the expanding gas turns the steam turbines that power the generators. All the process water is injected back into the underground geothermal reservoir.

The binary plant design was eliminated from further analysis because it utilizes lower temperature geothermal resources than those anticipated to occur within the HGLA. Binary process geothermal facilities were eliminated from consideration within the RFD, however, the eventual footprint such a facility might have is not expected to greatly differ from a dual-flash design facility on an acre of disturbance per MW basis.

2.4.3.2 Dry Steam Plant

Dry steam power plants are relatively simple and require only steam and condensate injection piping and minimal steam cleaning devices. They utilize steam produced directly from geothermal reservoirs to run the turbines that power the generator. No separation is necessary because wells only produce steam. Dry steam reservoirs, however, are rare and are not anticipated to exist within the HGLA.

2.4.3.3 Dry Cooling System

The HGLA is located in an area of scarce water resources. As an alternative to the proposed use of wet cooling towers, the BLM considered air-cooled or dry cooling towers for steam condensation. The efficiency of power generation for air cooled systems is affected by the difference between the temperature of the fluid exiting the turbine and the temperature of the cooling medium. The HGLA is located in the high desert and, during the summer months, energy demands increase due to higher ambient air temperatures and extensive use of air conditioners by businesses. The high temperatures would pose a problem with cooling the power plant, and overall efficiency would decrease during times of greatest need, therefore, air cooling was eliminated from further analysis because it is not feasible given the anticipated high temperatures expected in the HGLA.

2.4.4 Alternative Sites

Alternative sites were not considered since alternative sites would not meet the purpose of and need for this action which is to evaluate the HGLA for the potential to lease the area for geothermal exploration and development. This alternative has been eliminated from further consideration.

2.5 ALTERNATIVES COMPARISON

The table below is a side by side comparison of the proposed alternatives for the HGLA.

Table 2-3 HGLA Alternatives Comparison

	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E
The CDCA Plan would be amended: BLM administered lands within the HGLA are identified as open for geothermal leasing (up to 22,460 acres).	X		X	X	
The CDCA Plan would be amended: Specific acreages within the HGLA would be identified as open for geothermal leasing, but subject to restrictions on use such as CSU or NSO stipulations.			X	X	
The CDCA Plan would be amended: Specific acreages within the HGLA will be identified as closed for geothermal leasing, with other acreage identified as open.				X	
The CDCA Plan would be amended: All BLM administered lands within the HGLA would be closed for geothermal leasing.		X			
The CDCA Plan would not be amended: The CDCA Plan identifies the area as unclassified for geothermal leasing.					X
Groundwater extraction for consumptive use prohibited or restricted by stipulation.	X		X	X	
Pending geothermal applications would be denied.		X			X
Pending geothermal applications would be authorized.	X		X	X	

2.6 LEASE STIPULATIONS, MITIGATION MEASURES, BEST MANAGEMENT PRACTICES, AND PROCEDURES

2.6.1 Lease Stipulations

Lease stipulations are enforceable requirements or constraints that would be applied, as appropriate within the HGLA, to any geothermal lease that may be authorized under the action alternatives that would authorized geothermal exploration and development

(Alternatives A, C, and D). A lease stipulation is a condition of lease issuance that identifies processes or requirements that the lessee shall follow during all phases of the lease. These stipulations may be designed to provide protection for the federal government, provide clear steps to follow when certain conditions may occur, or provide protection to resource values or land uses. Standard stipulations from the Final Programmatic Environmental Impact Statement for Geothermal Leasing in the Western United States (PEIS), October 2008, along with Standard Stipulations on Form 3200-24a, are hereby adopted for this EIS and proposed plan amendment. Lease stipulations and procedures for the HGLA will be applied as outlined in the PEIS.

Any changes to these stipulations will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the application and use of these stipulations, see BLM Manual 1624 and 3101, or FS Manual 1950 and 2820.)

To ensure leasing decisions remain appropriate in light of continually changing circumstances and new information, the BLM develops and applies lease stipulation exception, waiver, and modification criteria. An exception, waiver, or modification may not be approved unless, (1) the authorized officer determines that the factors leading to the stipulation's inclusion in the lease have changed sufficiently to make the protection provided by the stipulation no longer justified; or (2) the proposed operations would not cause unacceptable impacts. (43 CFR 3101.1-4)

- An **exception** is a one-time exemption for a particular site within the leasehold; exceptions are determined on a case-by-case basis; the stipulation continues to apply to all other sites within the leasehold. An exception is a limited type of waiver.
- A **waiver** is a permanent exemption from a lease stipulation. The stipulation no longer applies anywhere within the leasehold.
- A **modification** is a change to the provisions of a lease stipulation, either temporarily or for the term of the lease. Depending on the specific modification, the stipulation may or may not apply to all sites within the leasehold to which the restrictive criteria are applied.

An exception, waiver, or modification may be approved if the record shows that circumstances or relative resource values have changed or that the lessee can demonstrate that operations can be conducted without causing unacceptable impacts and that less restrictive requirements would meet resource management objectives. This process is more fully explained in the PEIS, Chapter 2.2.2 and is incorporated in this document by reference.

STANDARD STIPULATIONS

In direct response to public comment, consultation, and staff recommendation, the following standard lease stipulations were developed for the HGLA. These stipulations will be required, and applied to each of the action alternatives that authorize geothermal leasing, Alternatives A, C, and D, with the two following exceptions: NSO-HGLA-1 shall only apply to Alternative C, and the application of SA-HGLA-10 to Alternative A is restricted as described in Section 2.3.1.

NO SURFACE OCCUPANCY (NSO) STIPULATIONS

NSO-HGLA-1: No surface occupancy or use is allowed on the lands within the identified sensitive resources area within the HGLA.

The sensitive resources area is defined by the geospatial data file pictured in the HGLA Final EIS, Figure 2.3.3-1. This area is nominally, but not exclusively identified by a specific set of plants, animals, and soils found within the HGLA. The data file provides latitude and longitude for each point along the NSO boundary between the Open areas and the NSO areas within the HGLA. All points along the NSO boundary shall be considered to be within the NSO area.

Should any question arise as to the absolute location of the NSO, the lessee shall be responsible for a professional survey that shall mark the NSO boundary with markers at periodic intervals that are acceptable to the authorized officer.

Purpose: This stipulation is for the protection of sensitive resources that include, but are not limited to, the Mojave Ground Squirrel, the Desert Tortoise, cultural resources, historical resources, and groundwater.

Exception: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan that demonstrates that impacts from the proposed action are minimal or can be adequately mitigated.

Modification: The boundaries of the stipulated area may be modified if the authorized officer determines that portions of the area can be occupied without adversely affecting the sensitive resources.

Waiver: This stipulation may be waived if the authorized officer determines that the entire leasehold can be occupied without adversely affecting the sensitive resources.

NSO-HGLA-2: No surface occupancy or surface use is allowed within the Rose Springs Area of Critical Environmental Concern (ACEC).

The Rose Springs ACEC can be found within the Mount Diablo Meridian and is defined as:

Township 21 South, Range 37 East,
Section 11, lot 1, 2, 9 to 11, inclusive, 14, W1/2NW1/4NW1/4NE1/4,
NW1/4SW1/4NW1/4NE1/4, NE1/4NW1/4, W1/2SE1/4SW1/4;

Section 14, lots 2, 3, lot 11, W1/2NE1/4NW1/4, NW1/4SW1/4, W1/2SW1/4SW1/4,
NE1/4SW1/4SW1/4, and NW1/4SE1/4SW1/4SW1/4;
Inyo County, California

Purpose: This stipulation is for the protection of cultural and historical resources found within the Rose Springs ACEC.

Exception: No exceptions will be granted.

Modification: No modifications will be granted.

Waiver: No waivers will be granted.

CONTROLLED SURFACE USE (CSU) STIPULATIONS

CSU-HGLA-1: The use of all lands within the HGLA shall be controlled with regard to the following set of stipulations. The HGLA is within the Mount Diablo Meridian and is generally defined as lands within the following sections:

Township 21 South, Range 37 East, Sections 11-14, 23-26, 35-36
Township 21 South, Range 38 East, Sections 7-10, 15, 17-22, 27-34
Township 22 South, Range 37 East, Sections 1-2, 11-12
Township 22 South, Range 38 East, Sections 5-8

Purpose: To conserve the Mojave Ground Squirrel (*XerospermophilusMojavensis*) (MGS) and its habitat. Potential MGS habitat is defined as any area where MGS is likely to occur based on compatible vegetation, soil, elevation, climate, and region.

Known MGS habitat is defined as those areas where MGS have been observed. The HGLA site contains potential and known habitat for the MGS. This habitat is identified by creosote bush scrub with a diverse mix of sub-shrubs and herbaceous plants, with shrubs in the Chenopodiaceae (spiny hopsage, winterfat, Atriplex species) being favored. Areas of potential MGS habitat within the HGLA have been identified using the criteria noted above. These areas are shown on Figure 2.3.3-1 and Figure 2.3.4-1.

- a) In areas where potential habitat for the MGS exists, presence shall be assumed and spring trapping surveys are to be conducted prior to any ground disturbing activity on undisturbed ground. Such surveys shall be conducted according to the California Department of Fish and Game (CDFG) protocol i.e. the trapping methodologies out-lined in the *California Department of Fish and Game Mojave Ground Squirrel Survey Guidelines*.
- b) If MGS are detected using trapping surveys or if known habitat is present and trapping is not conducted, the proponent must obtain a 2081 Incidental Take Permit from CDFG prior to proceeding with any ground disturbing activity.
- c) If trapping that follows CDFG protocol does not detect MGS, or if identified MGS habitat does not exist within the area of proposed disturbance, mitigation and a permit are not necessary for the year in which the ground disturbing activity will occur.
- d) If ground-disturbing activities do not begin within the year that trapping was conducted, presence of the species shall be assumed, and the procedure identified in a), above, shall be followed.

Exception: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan that demonstrates that impacts from the proposed action are minimal or can be adequately mitigated.

Modification: No modifications will be granted.

Waiver: No waivers will be granted.

CSU-HGLA-2: The use of all lands within the HGLA shall be controlled with regard to the following set of stipulations. The HGLA is within the Mount Diablo Meridian and is defined as lands within the following sections:

Township 21 South, Range 37 East, Sections 11-14, 23-26, 35-36
Township 21 South, Range 38 East, Sections 7-10, 15, 17-22, 27-34
Township 22 South, Range 37 East, Sections 1-2, 11-12
Township 22 South, Range 38 East, Sections 5-8

Purpose: to protect threatened, endangered, or other special status species, since the lease area may now or hereafter contain plants, animals, or their habitats determined to be threatened, endangered, or other special status species.

- a) BLM may require modifications to exploration and development proposals to further its conservation and management objective to avoid BLM-approved activity that will contribute to a need to list such a species or their habitat.
- b) BLM may require modifications to or disapprove proposed activity that is likely to result in jeopardy to the continued existence of a proposed or listed threatened or endangered species or result in the destruction or adverse modification of a designated or proposed critical habitat.
- c) BLM will not approve any ground-disturbing activity that may affect any such species or critical habitat until it completes its obligations under applicable requirements of the Endangered Species Act as amended, 16 USC 1531 et seq., including completion of any required procedure for conference or consultation.
- d) The holder shall comply with the Biological Opinion for listed and proposed species associated with this project signed by the US Fish and Wildlife Service. Failure to comply with the requirements of the Biological Opinion shall be cause for lease suspension or termination as provided in 43 CFR 3213.17 and 43 CFR 3200.4
- e) Unless otherwise agreed to in writing by the Authorized Officer, power lines shall be constructed in accordance with standards outlined in "Suggested Practices for Raptor Protection on Power lines", Raptor Research Foundation, Inc., 1996. The holder shall assume the burden and expense of proving that pole designs not shown in the above publication are "eagle safe." Such proof shall be provided by a raptor expert approved by the Authorized Officer. The BLM reserves the right to require modifications or additions to all power line structures placed on this right-of-way, should they be necessary to ensure the safety of large perching birds. Such modifications and/or additions shall be made by the holder without liability or expense to the United States.

- f) Bald and/or golden eagles may now or hereafter be found to utilize the project area. The BLM will not issue a notice to proceed for any project that is likely to result in take of bald eagles and/or golden eagles until the applicant completes its obligation under applicable requirements of the Eagle Act, including completion of any required coordination with the FWS or permit. The BLM hereby notifies the applicant that compliance with the Eagle Act is a dynamic and adaptable process which may require the applicant to conduct further analysis and mitigation following assessment of operational impacts. Any additional analysis or mitigation required to comply with the Eagle Act will be developed with the FWS and coordinated with the BLM.

Exception: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan that demonstrates that impacts from the proposed action are minimal or can be adequately mitigated.

Modification: No modifications will be granted.

Waiver: No waivers will be granted.

CSU-HGLA-3: The use of all lands within the HGLA shall be controlled with regard to the following set of stipulations. The HGLA is within the Mount Diablo Meridian and is defined as lands within the following sections:

Township 21 South, Range 37 East, Sections 11-14, 23-26, 35-36
Township 21 South, Range 38 East, Sections 7-10, 15, 17-22, 27-34
Township 22 South, Range 37 East, Sections 1-2, 11-12
Township 22 South, Range 38 East, Sections 5-8

Purpose: to protect historic properties and/or resources protected under the National Historic Preservation Act (NHPA), American Indian Religious Freedom Act, Native American Graves Protection and Repatriation Act, E.O. 13007, or other statutes and executive orders.

- a) The BLM will not approve any ground disturbing activities that may affect any such properties or resources until it completes its obligations under applicable requirements of the NHPA and other authorities.
- b) The BLM may require modification to exploration or development proposals to protect such properties, or disapprove any activity that is likely to result in adverse effects that cannot be successfully avoided, minimized or mitigated.

- c) Any cultural and/or paleontological resource (historic or prehistoric site or object) discovered by the holder, or any person working on its behalf, on public or Federal land shall be immediately reported to the Authorized Officer. The holder shall suspend all operations in the immediate area of such discovery until written authorization to proceed is issued by the Authorized Officer. An evaluation of the discovery will be made by the Authorized Officer to determine appropriate actions to prevent the loss of significant cultural or scientific values. The holder will be responsible for the cost of evaluation and any decision as to proper mitigation measures will be made by the Authorized Officer after consulting with the holder.
- d) Before any specific permits are issued under leases, treatment of cultural resources will follow the procedures established by the Advisory Council on Historic Preservation for compliance with Section 106 of the National Historic Preservation Act.
- e) All field work will be performed under a Cultural Resource Use Permit issued by the BLM.
- f) A pedestrian inventory will be undertaken for all portions that have not been previously surveyed or are identified by BLM as requiring inventory to identify properties that are eligible for the National Register of Historic Places (NRHP). Those sites not already evaluated for NRHP eligibility will be evaluated based on surface remains, subsurface testing, archival data, and/or ethnographic sources. Archaeological survey and subsurface investigation will be monitored by tribal representatives, if requested. Subsurface testing will be kept to a minimum whenever possible if sufficient information is available to evaluate the site or if avoidance is an expected mitigation outcome. Recommendations regarding the eligibility of sites will be submitted to the BLM. The BLM will make determinations of eligibility and effect and consult with the State Historic Preservation Offices (SHPO) as necessary based on each proposed lease application and project plans. The BLM may require modification to exploration or development proposals to protect such properties, or disapprove any activity that is likely to result in adverse effects that cannot be successfully avoided, minimized or mitigated. Avoidance of impacts through project design will be given priority over data recover as the preferred mitigation measure. Avoidance measures include moving project elements away from site locations or to areas of previous impacts, restricting travel to existing roads. Any data recovery will be preceded by approval of a detailed research design, tribal

consultation, and other requirements for BLM issuance of a cultural resource use permit under Federal Land Policy and Management Act (FLPMA).

- g) If an area exhibits a high potential for containing cultural resources, but no artifacts were observed during an archaeological survey, monitoring by a qualified archaeologist could be required during all excavation and earthmoving in the high-potential area.
- h) Based on the results of survey and other investigations, the BLM may require a Cultural Resource Management Plan (CRMP) that details site-specific mitigation activities. The CRMP also will: 1) establish a monitoring program; 2) identify measures to prevent potential looting/vandalism or erosion impacts; and 3) address the education of workers and the public to make them aware of the consequences of unauthorized collection of artifacts and destruction of property on public land.
- i) Unexpected discovery of cultural or paleontological resources during construction will be brought to the attention of responsible BLM authorized officer immediately. Work will be halted in the vicinity of the find to avoid further disturbance to the resources while they are being evaluated and appropriate mitigation measures are being developed.

Exception: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan that demonstrates that impacts from the proposed action are minimal or can be adequately mitigated.

Modification: No modifications will be granted.

Waiver: No waivers will be granted.

TIMING LIMITATION (TL) STIPULATIONS

TL-HGLA-1: The use of all lands within the HGLA shall be controlled with regard to the following set of stipulations. The HGLA is within the Mount Diablo Meridian and is defined as lands within the following sections:

Township 21 South, Range 37 East, Sections 11-14, 23-26, 35-36
Township 21 South, Range 38 East, Sections 7-10, 15, 17-22, 27-34
Township 22 South, Range 37 East, Sections 1-2, 11-12
Township 22 South, Range 38 East, Sections 5-8

Purpose: To conserve the Desert Tortoise (*Gopherus agassizii*) and its habitat, the following stipulations apply.

- a) The HGLA is near the northern extent of the desert tortoise range. Prior to ground disturbance, desert tortoise protocol surveys shall be conducted according to guidelines set forth by the Ventura Office of the U.S. Fish and Wildlife Service (USFWS) (http://www.fws.gov/ventura/speciesinfo/protocols_guidelines/).
- b) The lease holder shall conduct project exploration, development, and construction activities when desert tortoises are inactive (typically November 1 to March 14), to minimize impacts to roaming individuals.
- c) The lease holder shall retain a desert tortoise Authorized Biologist approved by CDFG and USFWS who would be responsible for ensuring compliance with desert tortoise stipulations prior to the initiation of and during ground-disturbing activities. The Authorized Biologist shall conduct clearance surveys, tortoise handling, artificial burrow construction, egg handling and other procedures in accordance with the *Guidelines for Handling Desert Tortoise during Construction Projects* (Desert Tortoise Council 1994) or the most current guidance provided by USFWS.
- d) The Authorized Biologist shall be present on-site from March 15 through October 31 (active season) during ground-disturbing activities in areas that have not been enclosed with tortoise exclusion fencing. The Authorized Biologist should be on-call from November 1 to March 14 (inactive season) and shall check construction areas that have not been enclosed with tortoise exclusion fencing immediately before construction activities begin at all times.
- e) The lease holder shall incorporate desert tortoise exclusion fencing, approved by USFWS and CDFG, into any permanent fencing surrounding the proposed facility prior to the initiation of ground disturbing activities to avoid potential harm to desert tortoise in the project area. Tortoise exclusion fencing should be constructed in accordance with the *Desert Tortoise Exclusion Fence Specifications* (USFWS 2005) or the most current guidance provided by USFWS and CDFG.
- f) The lease holder shall install desert tortoise exclusion fencing around temporary project areas such as staging areas, storage yards, excavations, and linear

facilities during construction. Construct fences in late winter or early spring to minimize impacts to tortoises and accommodate subsequent tortoise surveys.

- g) Within 24 hours prior to the initiation of construction of tortoise exclusion fence, the Authorized Biologist shall survey the fence alignment to ensure it is cleared of desert tortoises. Following construction of the tortoise-exclusion fence, the Authorized Biologist shall conduct clearance surveys within the fenced area to ensure as many desert tortoises as possible have been removed from the site.
- h) The lease holder shall install and regularly maintain gates that remain closed, except for the immediate passage of vehicles, to prevent desert tortoise passage into the project area.
- i) Heavy equipment shall only be allowed to enter the project site following the completion of desert tortoise clearance surveys of the project area by the Authorized Biologist. The Authorized Biologist shall monitor initial clearing and grading activities to ensure any tortoises missed during the initial clearance survey are moved from harm's way.
- j) The lease holder shall ensure that any damage to the permanent or temporary fencing is immediately blocked to prevent tortoise access and permanently repaired within 72 hours between March 15 and October 31, and within 7 days between November 1 and March 14. Following installation, the permanent fencing should be inspected quarterly and after major rainfall events to ensure fences are intact and there is no ground clearance under the fence that would allow tortoise to pass.
- k) The Authorized Biologist shall inspect any construction pipe, culvert, or similar structure with a diameter greater than 3 inches, stored less than 8 inches aboveground and within desert tortoise habitat (i.e., outside the permanently fenced area) for one or more nights, before the material is moved, buried or capped. As an alternative, all such structures may be capped before being stored outside the fenced area, or placed on pipe racks. These materials would not need to be inspected or capped if they are stored within the permanently fenced area after desert tortoise clearance surveys have been completed.
- l) The lease holder shall ensure vehicular traffic does not exceed 25 miles per hour within the delineated project areas or on access roads in desert tortoise habitat.

On unpaved roads the speed limit should be 10 miles per hour to suppress dust and protect air quality.

- m) Any time a vehicle or construction equipment is parked in desert tortoise habitat outside the permanently fenced area, the Authorized Biologist or drivers of the vehicle shall inspect the ground under the vehicle for the presence of desert tortoise before it is moved. If a desert tortoise is observed, it should be left to move on its own. If it does not move within 15 minutes, the Authorized Biologist may remove and relocate the animal to a safe location.
- n) The lease holder shall design culverts to allow safe passage of tortoises.
- o) If desert tortoise relocation is determined to be an appropriate conservation measure, the lease holder shall develop and implement a Desert Tortoise Translocation Plan for approval by CDFG, USFWS, BLM and other permitting agencies. The Plan shall designate a relocation site as close as possible to the disturbance site that provides suitable conditions for long term survival of the relocated desert tortoise and outline a method for monitoring the relocated tortoise.
- p) If desert tortoises are observed within the HGLA, consult with CDFG and USFWS to determine the need for and/or feasibility of conducting relocation or translocation as minimization or mitigation for project impacts. Development and implementation of a translocation plan may require, but not be limited to, additional surveys of potential recipient sites; disease testing and health assessments of translocated and resident tortoises; and consideration of climatic conditions at the time of translocation. Because of the potential magnitude of the impacts to desert tortoise from proposed renewable energy projects, CDFG and USFWS must evaluate translocation efforts on a project by project basis in the context of cumulative effects.
- q) If the desert tortoise protocol surveys indicate that there are no desert tortoises, and/or desert tortoise habitat, within the project area, the lease holder may apply for a waiver to one or more of the above stipulations.

Exception: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan that demonstrates that impacts from the proposed action are minimal or can be adequately mitigated.

Modification: No modifications will be granted.

Waiver: No waivers will be granted.

SPECIAL ADMINISTRATION (SA) STIPULATIONS

SA-HGLA-1: The BLM Authorized Officer for the administration of this lease is the Field Manager, Ridgecrest Field Office, Ridgecrest, CA; Phone 760-384-5400.

Exception: No exceptions will be granted.

Modification: No modifications will be granted.

Waiver: No waivers will be granted.

SA-HGLA-2: Unitization Stipulation – The lessee shall fully commit the lease to a geothermal unit acceptable to the Bureau of Land Management within 6 months of the effective date of the lease. Failure to commit the lease to a geothermal unit acceptable to the Bureau of Land Management shall subject the lease to cancellation.

Exception: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan that demonstrates that impacts from the proposed action are minimal or can be adequately mitigated.

Modification: No modifications will be granted.

Waiver: No waivers will be granted.

SA-HGLA-3: The lease holder shall construct, operate, and maintain the facilities, improvements, and structures within this geothermal lease area in strict conformity with the approved Plan of Development (POD), as amended or supplemented by approval of the Authorized Officer. All exploration, development, construction, and reclamation activities shall conform as nearly as possible to the latest edition of the BLM / U.S. Forest Service publication: The Gold Book – Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development. Any surface disturbing activity, additional construction, or use that is not in accord with the approved Plan of Development shall not be initiated without the prior written approval of the Authorized Officer. A copy of the lease, including all stipulations and approved Plan of Development, shall be available at all times onsite during construction, operation, and decommissioning. Noncompliance with the above will be grounds for immediate temporary suspension of activities if it constitutes a threat to public health or safety or the environment.

Exception: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan that demonstrates that impacts from the proposed action are minimal or can be adequately mitigated.

Modification: No modifications will be granted.

Waiver: No waivers will be granted.

SA-HGLA-4: Actions and activities of the lease holder within the HGLA will be governed by all mitigation measures and best management practices detailed in the *Best Management Practices and Guidance Manual: Desert Renewable Energy Projects*, September 2010, as directed by the Authorized Officer.

Exception: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan that demonstrates that impacts from the proposed action are minimal or can be adequately mitigated.

Modification: A modification to this stipulation may be granted by the authorized officer if the operator submits a plan that demonstrates that impacts from the proposed action are minimal or can be adequately mitigated.

Waiver: No waivers will be granted.

SA-HGLA-5: Actions and activities of the lease holder within the HGLA will be governed by all mitigation measures and best management practices as detailed in the *Geothermal Resources Leasing Programmatic EIS*, October 2008, as directed by the Authorized Officer.

Exception: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan that demonstrates that impacts from the proposed action are minimal or can be adequately mitigated.

Modification: A modification to this stipulation may be granted by the authorized officer if the operator submits a plan that demonstrates that impacts from the proposed action are minimal or can be adequately mitigated.

Waiver: No waivers will be granted.

SA-HGLA-6: The lease holder will be liable for all fire suppression costs resulting from fires caused during construction or operations. The holder shall comply with all guidelines and restrictions imposed by agency fire control officials.

Exception: No exceptions will be granted.

Modification: No modifications will be granted.

Waiver: No waivers will be granted.

SA-HGLA-7: The three non-competitive lease applications (CACA 043998, CACA 044082, CACA 043993) within the HGLA were pending on August 8, 2005. Therefore, all geothermal leases will be issued subject to the revised regulations at *43 CFR 3200.8 (b)(1) and (b)(3)*. The lease applicant must make its election, and provide written notice to the BLM of their preference for payment of royalties on production, before the lease may be issued.

Exception: No exceptions will be granted.

Modification: No modifications will be granted.

Waiver: No waivers will be granted.

SA-HGLA-8: Potential geothermal lessees should be aware of the revised due diligence requirements contained in the federal regulations at *43 CFR § 3207*. Leases are typically issued for an initial term of 10 years, and may be extended if diligent work requirements have been satisfied, and the BLM believes that the lessee has made satisfactory progress in complying with the lease terms and stipulations.

Exception: No exceptions will be granted.

Modification: No modifications will be granted.

Waiver: No waivers will be granted.

SA-HGLA-9: The BLM may, after giving you 30 days written notice, terminate your lease if we determine that you have violated any of the requirements of *43 CFR § 3200.4*, including, but not limited to compliance with the terms and conditions of the lease, including any and all lease stipulations, the nonpayment of required annual rentals or royalties and fees (*43 CFR § 3213.17*.)

Exception: No exceptions will be granted.

Modification: No modifications will be granted.

Waiver: No waivers will be granted.

SA-HGLA-10: The consumptive use of water within the HGLA shall be controlled with regard to the following set of stipulations. The HGLA is within the Mount Diablo Meridian and is defined as lands within the following sections:

Township 21 South, Range 37 East, Sections 11-14, 23-26, 35-36

Township 21 South, Range 38 East, Sections 7-10, 15, 17-22, 27-34

Township 22 South, Range 37 East, Sections 1-2, 11-12

Township 22 South, Range 38 East, Sections 5-8

Purpose: to protect and conserve the water resources that may be present within the HGLA and the Rose Valley Basin.

- a) Groundwater extraction for consumptive use during geothermal project operations will be prohibited throughout the entire HGLA, except as allowed under item (c) below.
- b) Groundwater extraction for consumptive use during geothermal exploration and development activities may be allowed, with the expressed approval of the Authorized Officer, for some leasing applications to the extent that groundwater extraction and water loss to the aquifer, in combination with all other authorized groundwater uses, does not exceed the safe yield (defined in item g) below) in the Rose Valley Aquifer, and does not cause a decline of 10% or more to the average annual fluctuation of water flowing into the surface features at Little Lake, when combined with all other approved uses.
- c) Groundwater extraction for consumptive use during geothermal project operations may only be allowed by approved exception, provided the proposed extraction and loss to the aquifer, meets the requirements for exploration and development activities for consumption: this use must not exceed the safe yield (defined in item g) below) in the Rose Valley Aquifer, and not cause a decline of 10% or more to the average annual fluctuation of water flowing into the surface features at Little Lake, when combined with all other approved uses. To obtain an exception, a plan of operations must be submitted along with mitigation and remediation plans that specifically address groundwater extraction for

consumptive use. An approved exception will consist of a declaration of exception, signed by the Authorized Officer, that will include other exception requirements to be determined on a per project, or per activity basis.

- d) Groundwater extraction for consumptive use during geothermal exploration, development, and project operations activities may be allowed, with the expressed approval of the Authorized Officer, for some leasing applications to the extent that groundwater extraction and water loss to the aquifer, in combination with all other authorized groundwater uses, does not exceed the safe yield (defined in item g) below) in the Rose Valley Aquifer, and does not cause a decline of 10% or more to the average annual fluctuation of water flowing into the surface features at Little Lake, when combined with all other approved uses.
- e) Water produced or used for the construction, operation, maintenance, or remediation of the project shall be solely for the beneficial use of the renewable energy project or its associated mitigation and remediation measures, as specified in approved plans and permits.
- f) The siting, construction, operation, maintenance, and remediation of all wells shall conform to specifications contained in the California Department of Water Resources Bulletins #74-81 and #74-90.
- g) A water supply assessment shall be prepared and must be approved by the Authorized Officer prior to the development or use of any water resources. This assessment shall identify the groundwater basin(s) and the surface water basin(s) related to water delivery and supply, as well as the aquifer(s) contained within them. A water budget shall be established based on the best available data and practices for the identified basin(s). This water budget shall classify and describe all water inflow and outflow to the identified basin(s) or system using the following basic hydrologic formula or a derivation: $P - R - E - T - G = \Delta S$, where P is precipitation and groundwater inflow, R is surface runoff or outflow, E is evaporation, T is transpiration, G is groundwater outflow, and ΔS is the change in storage. The volumes involved in this calculation shall be in units of acre-feet per year. Safe Yield is defined as that amount, such that $P - R - E - T - G$ is greater than or equal to zero.
- h) A Water Monitoring, Management, and Mitigation Plan shall be prepared and must be approved by the Authorizing Officer prior to the development or use of any water resources. The quality and quantity of all surface water and groundwater used for the project shall be monitored using this plan. The plan

shall detail the management and use of all project-related water resources. The plan shall also detail any mitigation measures that may be required as a result of the project.

- i) Ensure that any wastewater generated in association with temporary, portable sanitary facilities is periodically removed by a licensed hauler and disposed into an existing municipal sewage treatment facility.
- j) Temporary, portable sanitary facilities provided for construction crews should be adequate to support expected on-site personnel and should be removed at completion of construction activities.
- k) Comply with local requirements for permanent, domestic water use and wastewater treatment.
- l) Lease holder shall identify the source(s) of project water, and provide analysis proving that adequate quantity and quality of water are available from identified source(s) for the life of the geothermal project.

Exception: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan that demonstrates that impacts from the proposed action are minimal or can be adequately mitigated.

Modification: No modifications will be granted.

Waiver: No waivers will be granted.

2.6.2 Mitigation Measures and Best Management Practices (BMP)

In addition to the various lease stipulations, the BLM may also require a number of BMPs as conditions of any lease under the action alternatives. The Renewable Energy Action Team (REAT) agencies (California Energy Commission [CEC], California Department of Fish and Game [CDFG], BLM, and U.S. Fish and Wildlife Service (USFWS) jointly prepared the *Best Management Practices and Guidance Manual: Desert Renewable Energy Projects*, September 2010. The manual fulfills agency commitments in the State of California's Executive Order (EO) S-14-08, Secretary of the Interior Secretarial Order (S.O.) No. 3285, and related memoranda between California and the U.S. Department of Interior (DOI), and between the REAT agencies (signed in 2008 and 2009). The mitigation measures and BMPs proposed in the manual have been adopted for this EIS. Best Management Standards and Reclamation Performance Standards that are relevant to the HGLA, and may apply to all action alternatives that authorize geothermal leasing, are listed in Appendix A.

2.6.2.1 Mitigation Measures and Best Management Practices Specific to Geothermal

Agency Decisions and Permitting Guides

The BLM has published environmental BMPs on its website and in *The Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development* (BLM 2007) (commonly referred to as the Gold Book). Although these references were published as guidance and standards for the oil and gas industry, the mitigation measures for roads, transmission lines, pipelines, buildings, and screening are applicable guidance for developing and implementing BMPs for geothermal resource power plants. This document has been adopted for this EIS and will be applied to geothermal exploration and development within the HGLA.

The CEC approved the Salton Sea Unit #6 Power Project (CEC Publication No. 800-03-021, 2003) with conditions of certification and published a geothermal resources permitting guide (Blaydes & Associates 2007). Both documents provide examples of and explain in detail the requirements for developing geothermal wells and power plants in California. This document has been adopted for this EIS.

BMP's for geothermal energy are incorporated into this EIS by reference, from the Final Programmatic Environmental Impact Statement for Geothermal Leasing in the Western United States (PEIS). The Record of Decision for the Geothermal PEIS was signed on December 17, 2008.

Best Management Practices

Best Management Practices (BMP) are state-of-the-art mitigation measures applied on a site-specific basis to avoid, minimize, reduce, rectify, or compensate for adverse environmental or social impacts. They are applied to management actions to aid in achieving desired outcomes for safe, environmentally responsible resource development, by preventing, minimizing, or mitigating adverse impacts and reducing conflicts.

The BLM will incorporate appropriate environmental BMPs into proposed use authorizations after appropriate environmental review. Environmental BMPs to be considered in nearly all circumstances include the following:

- Interim reclamation of well locations and access roads soon after the well is put into production;
- Painting of all new facilities a color that best allows the facility to blend with the background, typically a vegetated background;

- Design and construction of all new roads to a safe and appropriate standard, “no higher than necessary” to accommodate their intended use; and
- Final reclamation of all disturbed areas, including access roads, to the original contour or a contour that blends with the surrounding topography.

Other environmental BMPs are more suitable for consideration by an administrative unit on a case-by-case basis, (1) depending on their effectiveness, (2) the balancing of increased operating costs vs. the benefit to the public and resource values, (3) the availability of less restrictive mitigation alternatives that accomplish the same objective, and (4) other site specific factors.

Guidelines for applying and selecting project-specific requirements include determining whether the measure would (1) ensure compliance with relevant statutory or administrative requirements, (2) minimize local impacts associated with siting and design decisions, (3) promote post construction stabilization of impacts, (4) maximize restoration of previous habitat conditions, (5) minimize cumulative impacts, or (6) promote economically feasible development of geothermal energy on BLM-administered lands.

Where the BMPs identified in the PEIS are inconsistent or incompatible with those developed under the HGLA EIS, the staff will determine the appropriate practices during the site-specific environmental review. Only those individual mitigation measures reasonably necessary to ensure environmentally responsible geothermal development should be selected. BMPs and mitigation measures should be dependent on factors such as the project size, location, site specific characteristics, and potential resource impacts. Prior to inclusion into a permit, the measures may be further modified to meet site-specific situations and agency requirements. Typical BMPs can also be found on the BLM Washington Office Fluid Minerals web site at: www.blm.gov/bmp and in Appendix A.

Geothermal project developers are advised to incorporate the general BMPs applicable to their project and project site. The following BMPs are specific to geothermal projects and are recommended for consideration by project developers. The BMPs below build on decisions and guides mentioned above in the Geothermal Energy Power Plants section of this section in addition to Environmental, Health and Safety Guidelines for Geothermal Power Development (International Finance Corporation 2007), recommended controls on hydrogen sulfide gas (H₂S) emissions (Nagl, n.d.), examples of waste discharge requirements (State of California Regional Water Quality Control Board [RWQCB], Colorado River Basin Region 2007), and injection well guidance (EPA 1999).

Air Quality

The following air quality BMPs include recommendations to reduce emissions of criteria or hazardous air pollutants and H₂S. The EPA does not classify H₂S as either a criteria air pollutant or a hazardous air pollutant. The State of California, however, adopted an Ambient Air Quality Standard for H₂S to protect public health and decrease odor annoyance. Air pollution control/management districts may have short-term, maximum (for example, hourly) and annual average standards for stationary sources of H₂S, including geothermal power plants. For example, the Imperial County Air Pollution Control District requires Best Available Control Technology be applied to geothermal power plants with the potential to emit more than 55 pounds per day of H₂S (County of Imperial 1999).

Develop an emissions inventory, a list of both long-term (annual) and short-term (generally hourly) emission rates for each relevant pollutant from each emission point source (such as well venting, drill rig diesel engines, fugitive dust, plant silencers, sulfur plant exhaust, cooling towers). Organize emissions inventory by project phase: well-field development (estimate number of wells to be drilled, vented each year); plant operations (estimate number of replacement wells to be drilled each year, and forced and planned outage rates). Quantify the pollutants contained in the geothermal fluids and steam by testing well venting. Collect fluid and gas samples for every well using independent laboratory and air quality specialist for at least one round of sample collection and chemical analysis.

- a) Own both the geothermal production and injection wells as well as the geothermal power plant, so that responsibility for H₂S emission control is not lost between the steam producer and electricity generator.
- b) As an integral part of an odor control program, implement an ambient monitoring program for H₂S and meteorology. Continue to operate the meteorological station used to collect baseline data. Use an EPA reference sulfur dioxide monitor with an in-line sulfur dioxide (SO₂) scrubber and H₂S to SO₂ oxidizer for real-time collection of less than 1 part per billion H₂S. Store hourly H₂S and wind data for use whenever odor issues arise.
- c) Remove H₂S from condensate by directing the condensate to the cooling tower to which chelated iron and sodium sulfite has been added to the cooling-tower water. These chemicals will react with the H₂S to form a water soluble chemical, which can be injected into the geothermal formation.
- d) Remove H₂S from both the condensate and non-condensable gas (NCG) stream by processing the NCG in a thermal oxidizer.

- e) When present in small volumes in the NCG stream, remove H₂S with liquid scavengers, rather than solid-based scavengers, so that the spent material can be injected into the geothermal formation for disposal rather than discarded in a landfill.
- f) When present in large volumes in the NCG stream, remove H₂S with a liquid redox system.
- g) Inject hydrogen peroxide and sodium hydroxide into a well's test line to abate H₂S emissions.

Hazards, Pesticides, Waste Management

- a) Increase the pH of spent geothermal brine to keep silica in solution prior to reinjection.
- b) Return spent geothermal brines, steam condensate, and cooling system blow-down to the geothermal resource via reinjection wells.
- c) Assure that hazardous substances and wastes removed from surface impoundments are not leaked, spilled, or otherwise improperly released outside the surface impoundments and into the environment.
- d) Remediate any contamination near and around surface impoundments, including the tops of berms and areas downwind from the impoundments, filter cake bay storage areas, hydroblast pads and adjacent areas, pipes containing hazardous waste scale and areas adjacent, and other areas where hazardous waste releases or disposals have occurred.
- e) Minimize releases of filter cake into the environment by enclosing filter cake bays with doors or replace filter cake bays with containers or trailers capable of holding the waste material.
- f) Prevent filter cake from being released or disposed of into the environment during the transfer to, from, or while stored at the filter cake bays or in end-dump trailers.
- g) Ensure that all employees and contractors staff operating at any facility receive appropriate hazardous waste management and high pressure high temperature (HPHT) training prior to conducting any work involving hazardous waste,

including hazardous waste treatment, storage, and disposal at the facility, or HPHT environments, including well site, pipeline, and power plant operations.

- h) Conduct annual environmental audits to identify all hazardous waste streams and determine compliance with all applicable statutory and regulatory provisions of California's Hazardous Waste Control Law and the Unified Hazardous Waste and Hazardous Materials Management Regulatory Program.
- i) Maintain a minimum freeboard of two feet at all times within the geothermal brine surface impoundment. Ensure the fluids and brine precipitates discharged to and contained in the surface impoundment never overflow.
- j) Install a leak detection system beneath the membrane liner of the geothermal brine surface impoundment. Inspect the system quarterly to ensure brine is not collecting due a membrane-liner breach.
- k) Monitor groundwater wells to determine whether the geothermal brine surface impoundment is releasing hazardous waste into groundwater.
- l) Clean conveyance systems regularly to prevent buildup of silica scale and the potential for release of solid materials from conveyance systems.
- m) Perform pipe maintenance and de-scaling only in areas designated for these activities.
- n) Construct hydro blasting areas so that the base is impermeable base and no wastewater can spray or run onto adjacent soil. For example, the hydro blasting area should have 12-foot-high walls on three sides. Convey wastewater from the hydro blasting process to the brine surface impoundment for reinjection to the geothermal resource.
- o) Containerize drilling mud and cuttings, when possible. Placing muds and cuttings in containers, such as Baker tanks, may not always be practical, but is a practice that avoids discharging such wastes to land.

Noise

BLM regulations seek to “minimize noise,” but set no measurable standard. BLM relies on noise criteria published in 1975 by the USGS in “Geothermal Resources Operational Order No. 4.” The order is applicable to people occupying nearby homes, hospitals, schools, and libraries and wildlife, according to the 2008 PEIS and states that federal land lessees may:

“not exceed a noise level of 65 dB(A) for all geothermal-related activity including but not limited to, exploration, development, or production operations as measured at the lease boundary line or 0.8 km (one-half mile) from the source, whichever is greater, using the A-weighted network of a standard Sound Level Meter. However, the permissible noise level of 65 dB(A) may be exceeded under emergency conditions or with [regulatory] approval if written permission is first obtained by the lessee from all residents within 0.8 km (one-half mile).”

Geothermal resource exploration/testing involves well drilling and less invasive approaches such as geophysical remote sensing. Remote sensing can refine well targeting and reduce the number of wells drilled. The exploration/testing approach is generally identified in a reservoir management plan.

- a) Use as few drill sites as is feasible so that fewer people are noise-impacted.
- b) Locate the sites as far from residences as possible. In addition, use terrain, such as ridges, and plan the drill site so that noise is projected away from residences, to shield noise impacts to the greatest extent possible. Within two miles of existing, occupied residences, consider restricting geothermal well drilling or major facility construction activities to non-sleeping hours (7 a.m. to 10 p.m.).
- c) To dampen drilling rig noise, install acoustical windows in structures occupied by affected parties.
- d) Install adequate noise abatement equipment during construction and operation, and maintain it in good condition to reduce noise from any drilling or producing geothermal well located within 1,500 feet of a habitation, school or church. Examples of such equipment include temporary noise shields, cyclone silencers, rock wall mufflers, and sound insulation in pipes. Silencers slow the velocity of steam in the steam processing facility.

Soils and Drainage

- a) Do not use geothermal fluids or exploratory well drilling muds for dust control on access roads, well pads, or within the facility area.

Water/Brine Injection and Water Supply

If geothermal power plants are properly designed and sited, water supply and well injection issues can be addressed. Flash geothermal power plants can satisfy up to 95 percent of their

water supply needs, including cooling tower make-up water, by recycling steam condensed from produced geothermal brine (CE Obsidian Energy LLC 2009). Water-cooled binary power plants require an external source of cooling water because the brine remains within a closed-loop system until injected. The brine may include concentrated amounts of contaminants which would present problems to the cooling system and the environment. Use of dry cooling or non-potable or degraded surface or groundwater would protect potable water supplies. Dry cooling can reduce the efficiency or electrical energy output of the power plant by as much as 50 percent in hot weather.

The quality of underground sources of drinking water can be protected through careful well and casing design. Contamination of groundwater aquifers could be caused by up flow through a fault or by leakage of the injected fluid behind the casing due to a poor cement bond or through a casing damaged by corrosion or mechanical causes.

Hydraulic fracturing, widely known as hydrofracking, is a well stimulation process that, if used, promotes subsurface fracture systems to facilitate the movement of the underground energy source—in this case geothermal fluid—from rock pores to production wells. Hydraulic fluids, typically consisting of water and chemical additives, are pumped into geological formation at high pressures. Once pressure is sufficient, the hydraulic fluid, or flowback fluid, will rise to the surface. Potential impacts associated with hydrofracking include the use of high volumes of water, potentially degrading local water resources, and the discharge of hydraulic fluid containing chemical additives that may result in contamination of groundwater and surface waters. Flowback water is either discharged to surface waters, regulated under the National Pollutant Discharge Elimination System (NPDES) program, or injected into the ground, regulated by the EPA or state Underground Injection Control (UIC) program. Currently, EPA is preparing a new study to evaluate the potential impacts of hydrofracking on drinking water and public health. The purpose of the study is to address recent concerns related to hydrofracking fluid and to update the findings of an EPA study that resulted in the exemption of hydrofracking fluid from regulation under the Safe Drinking Water Act UIC program (EPA 2011). Mitigation measures may include groundwater level and quality monitoring, as well as obtaining and complying with criterion set forth in applicable permits.

Geothermal operations may result in water loss through evaporation. Evaporative losses may vary from 5 to 33 percent (Clark 2010). Binary cycle geothermal power plants typically have lower evaporative losses (5 percent). To mitigate impacts associated with evaporative water losses, appropriate technologies, such as binary cycle, may be implemented.

Water/Brine Injection Well Best Management Practices

- a) Begin planning for injection early in the field development stage. Prepare a preliminary injection strategy as soon as the first few exploration and production wells have been drilled and tested.
- b) Use tracer testing and numerical modeling of the reservoir to develop an optimum injection strategy (disappointing production wells should not necessarily be converted to injection wells).
- c) Prevent injection pressure buildup with proper chemical treatment and/or filtering of the injection fluid to prevent scaling and/or plugging of injection wells.
- d) Increase the spacing between injection wells, or the number of injection wells, to redistribute the total amount of injection over a larger area and thereby correct for ground heaving.
- e) Avoid locating injection wells near known active faults and do not allow injection pressure to exceed original pore pressure to avert induced seismicity.
- f) Design wells with casing that run from the surface to the depth below the underground source of drinking water. A well should have two casing strings; each sealed its entire length. Test casings, cements, and other materials before selecting them for use in construction at the specific well site.
- g) At shallow depths, include multiple casing strings in geothermal wells.
- h) If injecting under pressure, monitor injection pressures to avoid excessive pressure and minimize likelihood of injection-induced seismic activity from increased subsurface pressure and the stresses on the injection well equipment.
- i) Inject at a rate that will not cause a pressure build-up in the formation or result in reduced fluid temperature at production wells. Monitor injection rates along with pressure monitoring to assess and ensure casing integrity.
- j) Design and construct cellars around the casing wellhead. Keep these cellars dry or well drained to prevent corrosion of the casing at the soil-air-water interface.
- k) Monitor well integrity to prevent unintended release from within the well to the surrounding formations and interzonal migration of fluids between the casing and the formation.

- l) Observe surface conditions daily for casing leaks.
- m) If an injection well penetrates an underground source of drinking water, perform mechanical integrity testing periodically to detect actual and potential leaks, casing failures, and cementing problems. Perform these tests prior to initial injection, after well workovers and repairs, and on a routine schedule during normal operations.

Water Supplies Best Management Practices

The use of surface or ground water for cooling a geothermal facility must be thoroughly evaluated and impacts mitigated. This assessment may result in lengthy delays of permitting timeframes.

- a) For flash-steam cycle plants minimize the use of fresh water by using geothermal fluid as the major source of cooling water. Use high-efficiency fills in cooling towers to enhance air-to-water contact.
- b) For binary geothermal plants, use air-cooled condensers only, during fall, winter and spring (October through April). During the summer season (May through September), plant electrical efficiency can be improved by using one of the following pre-cooling strategies:
 - a. Direct deluge cooling of the air-cooled condenser tubes. Add a purified water rinse to wash away new forming scale when the deluge system is shut down for the winter.
 - b. Spray-cooling enhancement (that is, pre-cooling with spray nozzles capable of creating micron-sized water droplets).
 - c. Honey-comb, porous evaporative-cooling media (for example, Munters media). Use degraded or reclaimed water sources for geothermal-source water supplies as much as possible. Minimize use of fresh or potable water supplies.

Sufficient water supply (for construction, cooling, geothermal makeup water, etc.) must be guaranteed by an applicant before the lease can be approved. The Applicant may need a Conditional Use Permit (CUP) approved by Inyo County to present to BLM before any lease would be granted. Water consumption and use would be evaluated during the NEPA process at the project level.

Monitoring

The mitigation measures, lease stipulations, conditions of approval, and the construction, operation, maintenance, and reclamation of the geothermal developments, will be monitored to ensure their continued effectiveness and compliance through all phases of the project. When compliance is determined to be ineffective, the BLM will take steps to determine the cause and require the operator to take corrective action which may include stopping operations until compliance is restored as determined by the Authorized Officer.

CHAPTER 3

AFFECTED

ENVIRONMENT

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CHAPTER 3 **AFFECTED ENVIRONMENT**

This chapter describes the existing conditions of the physical, biological, cultural, and socioeconomic resources that have the potential to be affected by activities related to the alternatives discussed in Chapter 2. These resources include: air quality, climate, sounds, topography, geology, seismicity, soils, water, plants, animals, cultural resources, historical and prehistoric sites, paleontology, view sheds, lands and realty, health and safety, energy, minerals, wild horses and burros, grazing, recreation, and transportation. The resources that occur within the project area, or are adjacent to or otherwise associated with the area, have been included with those resources identified during the scoping process and in the BLM interdisciplinary team review. More detailed information on existing conditions for air quality, biological, cultural, and paleontological resources is documented in technical reports to be found in the Appendices. The resources and baseline conditions described here represent the current conditions of the environment that the HGLA program alternatives could affect. The impact assessment in Chapter 4, Environmental Consequences, focuses on these same resources and baseline conditions.

3.1 INTRODUCTION AND OVERVIEW

3.1.1 Geographic Setting

The Haiwee Geothermal Leasing Area (HGLA) encompasses 38 sections, but BLM responsibility does not include the one section of State of California land (Township 21 South, Range 38 East, Section 16, MDM). The HGLA is primarily undeveloped desert lands within a sparsely populated area of south-central California. The HGLA is located in the West Mojave Desert of southwestern Inyo County, California (see Figures 1.1-1 and 1.1-2) and includes approximately 22,805 acres of federally managed mineral estate. The HGLA lies in Rose Valley which is topographically separated from the Owens Valley to the north by Dunsmuir Hill. These two valleys are bounded by the front range of the Sierra Nevada to the west, and the Coso Range to the east. U.S. Highway 395 (US 395), the primary north-south roadway through the valleys, provides the primary access to the HGLA from southern California and northern Nevada. In contrast, the local road network in the vicinity of the HGLA consists of a few secondary roads. The Sykes-Gill Station Road (also called the Coso-Gill Station Road) at Coso Junction provides access to the interior of the HGLA (see Figure 1.1-3 and Appendix I).

The HGLA is isolated from the major economic hubs such as Bakersfield, a two-hour drive to the west, and Los Angeles or Las Vegas, each located approximately a four-hour drive

from the HGLA. There are a number of small, unincorporated communities along the US 395 corridor north and south of the HGLA. Two incorporated cities in the general vicinity of the HGLA are Ridgecrest and California City, both located to the south in northeast Kern County. Independence, the seat of Inyo County, is located 50 miles to the north of the HGLA. Other small, unincorporated communities in the vicinity include Haiwee, Olancho, Dunsmuir, Coso Junction, and Little Lake. Coso Junction is within the HGLA.

To the east of the HGLA is the China Lake Naval Air Weapons Station (NAWS), a federal 1.1 million-acre installation with a mission of weaponry research, development testing and evaluation, and weapons training. NAWS includes housing facilities for staff, military personnel and visitors. The 606,000-acre North Range of the NAWS adjoins the eastern portions of the HGLA.

To the north of the HGLA, in the Owens Valley, are the North and South Haiwee Reservoirs. The Los Angeles Department of Water and Power (LADWP) own and operate these reservoirs along with the two associated Los Angeles aqueducts.

The privately owned Little Lake Ranch is located at the southern end of Rose Valley. Little Lake Ranch is a 1,200-acre area to the north of the 90-acre Little Lake, which includes a number of smaller ponds and wetlands.

The Coso Geothermal Area, located to the southeast of the HGLA, is an existing geothermal power plant complex located within the China Lake NAWS. As of January 2010, re-injection water for the Coso Geothermal complex is being provided via a new pipeline in the northern Rose Valley, from the Hay Ranch (see Figure 1.1-3). The supply wells for this water are located on private land within the interior of the HGLA. This water re-injection system recharges water needed for operations of the Coso geothermal reservoir.

Over ninety percent of the lands in Inyo County are federally owned, with less than two percent in private ownership. This pattern is reflected in the HGLA where over 90 percent of the total of 24,320 acres is federally owned and administered by the BLM. One section (640 acres) of land within the HGLA is administered by the California State Lands Commission. No National Forest or designated wilderness area lands are located on or adjacent to the HGLA.

3.2 AIR QUALITY AND CLIMATE

3.2.1 Applicable Regulations, Plans, Policies/Management Goals

The Clean Air Act (CAA) establishes air quality planning processes and requires areas in nonattainment of a National Ambient Air Quality Standard (NAAQS) to develop a State Implementation Plan (SIP) that details how the state will attain the standard within mandated time frames. The requirements and compliance dates for attainment are based on the severity of the nonattainment classification of the area. The national and state ambient air quality standards are shown in Table 3.2-1.

The following summarizes the air quality rules and regulations that apply to the HGLA.

Federal Regulations

Section 176(c) of the CAA, as articulated in the United States Environmental Protection Agency (USEPA) General Conformity Rule (40 CFR 93), states that a federal agency cannot issue a permit for, or support, an activity unless the agency determines that it will conform to the most recent USEPA-approved SIP. This means that projects using federal funds or requiring federal approval must not (1) cause or contribute to any new violation of a NAAQS, (2) increase the frequency or severity of any existing violation, or (3) delay the timely attainment of any standard, interim emission reduction, or other milestone. The HGLA is primarily within the federal Coso Junction PM₁₀ Planning area which is classified as a federal attainment/maintenance area for PM₁₀. A very small area on the northern boundary of the HGLA is within the Owens Valley PM₁₀ Planning area. The Owens Valley Planning area is classified as a serious nonattainment area for PM₁₀ by the USEPA. These classifications necessitate a conformity analysis for both of these planning areas. The HGLA is currently in attainment of all of the other NAAQS.

State Regulations

The California Air Resources Board (CARB) has oversight over air quality in the state of California. Regulation of individual stationary sources and area sources has been delegated to local air pollution control agencies. CARB is responsible for developing programs designed to reduce emissions from mobile sources, including motor vehicles and off-road equipment.

CARB and the California Office of Environmental Health Hazard Assessment (OEHHA) are also responsible for developing regulations governing toxic air contaminants (TACs). TACs include air pollutants that can cause serious illnesses or increased mortality, even in low concentrations. CARB and the OEHHA identify specific air pollutants as TACs, develop health thresholds for exposure to TACs, and develop guidelines for conducting health risk assessments for sources of TIC emissions.

Table 3.2-1 National and California Ambient Air Quality Standards

Pollutant	Averaging Time	California Standards	Primary National Standards^{a,b,c}	Secondary National Standards^{a,b,d}
Ozone (O ₃)	8-hour	0.070 ppm (137 µg/m ³)	0.075 ppm (147 µg/m ³)	Same as primary
	1-hour	0.09 ppm (180 µg/m ³)	—	—
Carbon monoxide (CO)	8-hour	9.0 ppm (10 mg/m ³)	9 ppm (10 mg/m ³)	—
	1-hour	20 ppm (23 mg/m ³)	35 ppm (40 mg/m ³)	—
Nitrogen dioxide (NO ₂)	Annual	0.030 ppm (56 µg/m ³)	0.053 ppm (100 µg/m ³)	Same as primary
	1-hour	0.18 ppm (338 µg/m ³)	—	—
Sulfur dioxide (SO ₂)	Annual	—	0.030 ppm (80 µg/m ³)	—
	24-hour	0.04 ppm (105 µg/m ³)	0.14 ppm (365 µg/m ³)	—
	3-hour	—	—	0.5 ppm (1,300 µg/m ³)
	1-hour	0.25 ppm (655 µg/m ³)	—	—
PM ₁₀	Annual	20 µg/m ³	—	—
	24-hour	50 µg/m ³	150 µg/m ³	Same as primary
PM _{2.5}	24-hour	—	35 µg/m ³	—
Lead	Rolling 3-month period	—	0.15 µg/m ³	Same as primary
	Calendar Quarter	—	1.5 µg/m ³	Same as primary
	30-day average	1.5 µg/m ³	—	—
Hydrogen Sulfide	1-hour	0.03 ppm (42 µg/m ³)	—	—
Visibility Reducing Particles	8 Hour	Extinction coefficient of 0.23 per kilometer – visibility of ten miles or more due to particles where relative humidity is less than 70 percent ¹ .	None	None
Sulfates	24 Hour	25 µg/m ³	None	None
Vinyl Chloride	24 Hour	0.01 ppm (26 µg/m ³)	None	None

Source: California Air Resources Board. 2010. Ambient Air Quality Standards Chart:

<http://www.arb.ca.gov/research/aaqs/aaqs2.pdf>

Notes: µg/m³=micrograms per cubic meter

(a) Standards other than the 1-hour ozone, 24-hour PM₁₀, 24-hour PM_{2.5}, and those based on annual averages are not to be

-
- exceeded more than once a year. The 8-hour ozone national standard has replaced the 1-hour ozone national standard.
- (b) Concentrations are expressed first in units in which they were promulgated. Equivalent units given in parenthesis.
 - (c) Primary Standards: The levels of air quality necessary, with an adequate margin of safety to protect the public health. Each state must attain the primary standards no later than three years after that state's implementation plan is approved by the USEPA.
 - (d) Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.
- (1) Method: Beta Attenuation and Transmittance through Filter Tape.

Local Regulations

The HGLA is located in the jurisdiction of the Great Basin Unified Air Pollution Control District (GBUAPCD). The GBUAPCD is responsible for regulating stationary and area sources of air emissions in the HGLA. Stationary sources, such as geothermal plants, and area sources such as construction and off highway travel that have the potential to emit air pollutants into the ambient air are subject to the rules and regulations adopted by the GBUAPCD.

The GBUAPCD prepared its PM₁₀ *Maintenance Plan and Redesignation Request for the Coso Junction Planning Area (CJPL)*, which was adopted by the Governing Board on May 17, 2010. The plan was approved by the USEPA September 3, 2010. As part of that approval by the USEPA, the CJPL was redesignated as a maintenance area for PM₁₀. The SIP indicated that maintenance of the PM₁₀ standard for the CJPL is dependent on emission reductions in the Owens Valley PM₁₀ Planning area. The plan also indicates that local sources within the CJPL do not have a significant impact on PM₁₀ concentrations in the CJPL.

In addition to concerns regarding PM₁₀, the GBUAPCD monitors hydrogen sulfide (H₂S) within the region including the HGLA. H₂S occurs in the geothermal fluids at the Coso Geothermal plant. The Coso plant employs a scrubber to remove sulphur from the fluids. Any development within the HGLA would be required to obtain necessary permits and approval from GBUAPCD. Hydrogen sulfide “is now routinely abated at geothermal power plants, resulting in the conversion of over 99.9 percent of the hydrogen sulfide from geothermal noncondensable gases into elemental sulfur, which can then be used as a non-hazardous soil amendment and fertilizer feedstock.” (Kagel, Bates, Gawell, 2005)

Resource Overview

Air quality is defined by ambient air concentrations of specific pollutants determined by the USEPA to be of concern with respect to the health and welfare of the general public. Ambient air quality refers to the atmospheric concentration of a specific compound (amount of a pollutant in a specified volume of air) that occurs at a particular geographic location. Emissions, meteorology, and chemistry affect the ambient air quality levels measured at a particular location.

Pollutant emissions typically refer to the amount of pollutants or pollutant precursors introduced into the atmosphere by a source or group of sources. Pollutant emissions contribute to the ambient air concentrations of criteria pollutants, either by directly affecting the pollutant concentrations measured in the ambient air or by interacting in the atmosphere to form criteria pollutants.

Pollutants are defined as two general types: (1) “criteria” pollutants and (2) toxic compounds. Criteria pollutants have national and/or state ambient air quality standards. The USEPA establishes the NAAQS, while CARB establishes the state standards, termed the California Ambient Air Quality Standards (CAAQS).

Criteria Pollutants

Seven major pollutants of concern, called “criteria pollutants,” are carbon monoxide (CO), sulfur dioxide (SO₂), nitrogen dioxide (NO₂), ozone (O₃), PM₁₀, fine particulate matter less than or equal to 2.5 µm in diameter (PM_{2.5}), and lead (Pb). The USEPA has established NAAQS for these pollutants.

Toxic Air Contaminants (TAC)

TACs are substances that have the potential to be emitted into the ambient air and have been determined to present some level of acute or chronic health risk (cancer or non-cancer) to the general public. These pollutants may be emitted in trace amounts from various types of sources, including combustion sources.

Greenhouse Gas Emissions (GHG)

GHGs are gases that trap heat in the atmosphere. These emissions occur from natural processes as well as human activities. The accumulation of GHGs in the atmosphere impact the earth’s temperature. Scientific evidence indicates a trend of increasing global temperature over the past century, which a number of scientists attribute to an increase in GHG emissions from human activities. The climate change associated with this global warming is predicted to produce negative economic and social consequences across the globe.

The most common GHGs emitted from natural processes and human activities include carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O). Each GHG is assigned a global warming potential. The global warming potential is the ability of a gas or aerosol to trap heat in the atmosphere. The global warming potential rating system is standardized to CO₂, which has a value of one. For example, CH₄ has a global warming potential of 21, which means that it has a global warming effect 21 times greater than CO₂ on an equal-mass basis. Total GHG emissions from a source are often reported as a CO₂ equivalent (CO₂e). The CO₂e is calculated by multiplying the emission of each GHG by its global warming potential and adding the results together to produce a single, combined emission rate.

representing all GHGs. On a national scale, federal agencies are addressing emissions of GHGs by reductions mandated in federal laws and Executive Orders. Most recently, Executive Order 13423 Strengthening Federal Environmental, Energy, and Transportation Management (January 24, 2007) was enacted. Several states have promulgated laws as a means to reduce statewide levels of GHG emissions. In particular, the California Global Warming Solutions Act of 2006 directs the State of California to reduce statewide GHG emissions to 1990 levels by the year 2020. It is important to note that CO₂ emissions from geothermal energy power facilities are insignificant in comparison to those from fossil fuel power facilities.

The potential effects of proposed GHG emissions are by nature global, and have cumulative impacts. However, the current state of the science does not allow the measurement or analysis of the climate change impacts that might be associated with GHG emissions from a particular project on a localized or even global level. The Air Resources Management Program Manual (BLM 2009) contains the BLM's guidance on incorporating assessment of climate change issues into BLM planning and NEPA documents. The guidance requires that air resource management programs consider and analyze potential climate change impacts when undertaking long-range planning exercises, setting priorities for scientific research and investigations, and/or when making major decisions affecting resources. The BLM guidance was followed in evaluating potential impacts on global climate.

3.2.2 Regional Climate

The climate of the HGLA is classified as high desert climate characterized by dry, hot summers and cool winters. The major influences on the regional climate are the Eastern Pacific high pressure system, the Sierra Nevada mountain range to the west, and the mountain ranges to the east of the HGLA.

The Western Regional Climate Center (WRCC 2009) archives weather data for the western US. Data is available for the Haiwee Reservoir Area, located on the north side of the study area, for the period since May 1, 1923. Data through April 30, 2009 was used in this EIS. The Haiwee weather station monitors temperature, precipitation (including snowfall). Monthly average temperatures and precipitation for the HGLA are summarized in Table 3.2-2.

Table 3.2-2 Monthly Average Temperatures and Precipitation – Haiwee Meteorological Station

Month	Temperature, °F				Precipitation, Inches	
	Maximum	Standard Deviation	Minimum	Standard Deviation	Measurement	Standard Deviation
January	51.71	5.09	29.00	4.38	1.05	1.44
February	56.51	4.44	32.58	3.78	1.30	1.51
March	62.89	4.74	37.16	3.26	0.87	1.07
April	70.38	4.45	43.53	4.08	0.34	0.52
May	79.52	4.56	51.44	3.68	0.22	0.36
June	88.88	3.74	59.15	3.19	0.10	0.21
July	95.48	2.99	65.82	3.40	0.23	0.49
August	93.81	2.97	63.89	2.99	0.29	0.56
September	86.72	3.07	57.14	3.45	0.28	0.53
October	75.65	4.04	47.15	3.27	0.27	0.72
November	62.02	3.85	36.50	3.06	0.56	0.97
December	52.60	3.95	30.06	2.98	0.95	1.14
Annual	72.87	1.86	46.35	2.10	6.55	3.55

Source: <http://www.wrcc.dri.edu/CLIMATEDATA.html>

The mean annual temperature for the Haiwee monitoring station is 59.36 degrees Fahrenheit (°F) with a standard deviation of 0.98 °F. The long-term trend in temperatures at the Haiwee monitoring station is down about one degree since the 1920s. An analysis of the Haiwee temperature data from 1924 (first year with complete data) to 2009 shows that the five-year mean temperature has declined over the last 10 years, and is currently below the long-term mean temperature.

The mean precipitation for the Haiwee monitoring station is 6.55 inches. The precipitation has ranged between 17.27 and 1.85 with a standard deviation of 3.58 inches. The data show that the precipitation is not equally distributed throughout each month of the year and falls mostly in the winter cool season. In the 2007 water year, there was little rainfall (0.95 inches) which is about 14% of normal. The rainfall in water year 2008 was 1.91 inches which is 28% of normal.

3.2.3 Existing Conditions

The HGLA is located within the Great Basin Valleys Air Basin (GBVAB), which encompasses Alpine, Mono, and Inyo Counties. The GBUAPCD administers oversight of the air quality in the GBVAB.

The GBUAPCD operates a series of ambient air quality monitoring stations throughout the Great Basin Valleys Air Basin. The closest monitoring sites to the HGLA are located in

Olancho and Coso Junction. The Olancho monitoring station only measures PM_{10} , and the Coso Junction monitoring station measures PM_{10} and H_2S . H_2S is monitored in the Coso Junction area due to concerns regarding emissions from geothermal plants. The only monitoring station in the GBVAB that measures ozone is located in Death Valley National Park to the east of the site. However, ozone concentrations at the Death Valley monitoring station are likely to be representative of site conditions, as ozone levels in the region are usually the result of transport rather than localized emissions, and ozone is considered a basin-wide pollutant. The only monitoring station in the GBVAB that measures $PM_{2.5}$ is located at Keeler, near Owens Lake to the north of the HGLA; this monitoring station likely experiences higher levels of $PM_{2.5}$ than the HGLA. CO , NO_2 , and SO_2 are not monitored within the Great Basin Valleys Air Basin and are not considered to be of concern with regard to attainment of the ambient air quality standards.

Table 3.2-3 provides a summary of background air quality representative of the HGLA.

Table 3.2-3 Representative Air Quality Data for the HGLA (2004-2008)

Air Quality Indicator	2004	2005	2006	2007	2008
Ozone (O_3)⁽¹⁾					
Peak 1-hour value (ppm)	0.086	0.105	0.092	0.107	0.098
Days above state standard (0.09 ppm)	0	1	0	3	1
Peak 8-hour value (ppm)	0.081	0.101	0.088	0.094	0.094
Days above state standard (0.070 ppm)	28	47	33	35	21
Days above federal standard (0.075 ppm) ^(2, 6)	9	24	9	18	5
Particulate matter less than or equal to 10 μm in diameter (PM_{10})⁽³⁾					
Peak 24-hour value ($\mu\text{g}/\text{m}^3$)	409	67	92	114	357
Days above state standard (50 $\mu\text{g}/\text{m}^3$)	2	2	2	2	*
Days above federal standard (150 $\mu\text{g}/\text{m}^3$)	1	0	0	0	5
Annual Average value (ppm)	24.4	22.3	21.9	21.5	22.3
Particulate matter less than or equal to 10 μm in diameter (PM_{10})⁽⁷⁾					
Peak 24-hour value ($\mu\text{g}/\text{m}^3$)	66	97	77	283	137
Days above state standard (50 $\mu\text{g}/\text{m}^3$)	2	2	1	*	*
Days above federal standard (150 $\mu\text{g}/\text{m}^3$)	0	0	0	2	0
Annual Average value (ppm)	15.1	18.9	14.3	19.4	18.4
Particulate matter less than or equal to 2.5 μm in diameter ($PM_{2.5}$)⁽⁴⁾					
Peak 24-hour value ($\mu\text{g}/\text{m}^3$) ⁽⁵⁾	81	22	193	57	58
Days above federal standard (35 $\mu\text{g}/\text{m}^3$)	1	0	1	2	4
Annual Average value (ppm)	*	*	*	5.8	7.1
Hydrogen Sulfide (H_2S)⁽⁷⁾					
Peak 1-hour value (ppm)	0.007	0.005	0.003	0.003	0.003
Days above state standard (0.03 ppm)	0	0	0	0	0

Source: CARB, 2010. ADAM Air Quality Data Statistics.

<http://www.arb.ca.gov/adam/topfour/topfourdisplay.php>

Notes: ⁽¹⁾ Data from the Death Valley monitoring station.

⁽²⁾ The federal ozone standard was revised downward in 2008 to 0.075 ppm.

⁽³⁾ Data from the Olancho monitoring station.

⁽⁴⁾ Data from the Keeler monitoring station.

⁽⁵⁾ The federal $PM_{2.5}$ standard was revised downward in 2007 to 35 $\mu\text{g}/\text{m}^3$.

⁽⁶⁾ The federal eight-hour ozone standard was previously defined as 0.08 ppm (1 significant digit). Measurements were rounded up or down to determine compliance with the standard; therefore a measurement of 0.084 ppm is rounded to 0.08 ppm. The 8-hour ozone ambient air quality standards are met at an ambient air quality monitoring site when the average of the annual fourth-highest daily maximum 8-hour average ozone concentration is less than or equal to the standard.

⁽⁷⁾ Data from the Coso Junction monitoring station.

ppm = parts per million; $\mu\text{g}/\text{m}^3$ = micrograms per cubic meter; * = not available

3.2.4 Compliance with Air Quality Standards

The GBVAB is considered an unclassified/attainment area for the NAAQS for ozone, CO, NO₂, PM_{2.5}, and SO₂. In the area of the HGLA, the Owens Valley is classified as a serious nonattainment area for the NAAQS for PM₁₀, and the Coso Junction area is classified as a maintenance area for the NAAQS for PM₁₀.

The USEPA is proposing to lower the 8-hour ozone standard to within a range of 0.060 and 0.070 ppm. The ambient air monitoring station at Death Valley measures 8-hour ozone concentrations above this level, and its three-year average 8-hour ozone concentration is 0.081 ppm. This level is above both the current standard and the proposed lower standard for ozone. In January 2009, the GBUAPCD recommended to CARB that southeast Inyo County be redesignated as an ozone nonattainment area since 65 exceedances of the 8-hour NAAQS of 0.075 ppm were recorded. In response, CARB has recommended to the USEPA that the region be redesignated as an ozone nonattainment area. Should this occur, the GBUAPCD will be required to develop an air quality management plan for ozone. The GBVAB is considered an unclassified/attainment area for the CAAQS for CO, NO₂, PM_{2.5}, and SO₂. Inyo County is considered an unclassified area for the 1-hour CAAQS for ozone, but Mono and Inyo Counties are classified as nonattainment areas for the 8-hour CAAQS for ozone. The air basin is a nonattainment area for the CAAQS for PM₁₀. Table 3.2-4 shows Inyo County's attainment status with regard to the CAAQS and NAAQS.

Table 3.2-4 HGLA Attainment Status

Standard	CAAQS Attainment Status	NAAQS Attainment Status
O ₃ – 1-hour	Unclassified	Unclassified/Attainment
O ₃ – 8-hour	Nonattainment	Unclassified/Attainment
PM _{2.5} – 24-hour	Unclassified/Attainment	Unclassified/Attainment
PM _{2.5} – Annual	Unclassified/Attainment	Unclassified/Attainment
PM ₁₀ – 24-hour	Nonattainment	Attainment/Maintenance
PM ₁₀ – Annual	Nonattainment	Unclassified/Attainment
CO	Unclassified/Attainment	Unclassified/Attainment
NO ₂	Unclassified/Attainment	Unclassified/Attainment
SO ₂	Unclassified/Attainment	Unclassified/Attainment
Sulfates	Unclassified/Attainment	N/A
Lead	Unclassified/Attainment	Unclassified/Attainment
H ₂ S	Unclassified/Attainment	N/A
Visibility Reducing Particles	Unclassified/Attainment	N/A

N/A = Not Applicable

Source: USEPA 2010. The Green Book Nonattainment Areas for Criteria Pollutants:

<http://epa.gov/airquality/greenbk/>

3.3 NOISE

3.3.1 Applicable Regulations, Plans, Policies/Management Goals

The Public Safety Element of the Inyo County General Plan provides a program for incorporating noise issues into the land use and planning process, with a goal of minimizing adverse noise impacts to sensitive noise receptors. The Noise section of the Public Safety Element establishes goals and policies to protect the public from noise intrusion. The noise restrictions for Inyo County are applicable to lands owned or zoned by the county, and lands regulated by the state or federal government. Eight percent of the total area within the HGLA is privately or state-owned land that is subject to the goals and objectives of the noise restrictions of the Public Safety Element of the Inyo County General Plan. Potentially applicable goals and policies include:

- **Goal 1:** Prevent incompatible land uses, by reason of excessive noise levels, from occurring in the future.
 - Policy NOI-1.1 Acceptable Noise Limits - The county shall utilize the noise levels shown in County noise standards for evaluating project compatibility related to noise.
 - Policy NOI-1.2 Exposure to Existing Noise from Stationary Sources - The county shall not allow new development within areas where existing noise levels currently exceed County noise standards, unless mitigation measures would reduce impacts to future occupants.
 - Policy NOI-1.3 Limit Increases in Noise Levels from Stationary Sources - Require that new development not increase the ambient exterior noise level (measured at the property line) above established county noise standards, unless mitigation measures are included to reduce impacts to below county noise standards.
 - Policy NOI-1.5 Implementation of Mitigation Measures - Require that proponents of new projects provide or fund the implementation of noise-reducing mitigation measures to reduce noise to required levels.
 - Policy NOI-1.7 Noise Controls During Construction - Contractors will be required to implement noise-reducing mitigation measures during construction when residential uses or other sensitive receptors are located within 500 feet.
- **Goal 2:** Preserve and maintain a quiet rural environmental character.

- Policy NOI-2.1 Rural Roadways - Maintaining two-lane county roadways is encouraged where feasible. Widening and expansion of county roadway facilities is discouraged unless required to provide necessary capacity.

3.3.2 Affected Environment

Noise is generally defined as unwanted or annoying sound that is typically associated with human activity, and that interferes with or disrupts normal activities. Although exposure to high noise levels has been demonstrated to cause hearing loss, the principal human response to environmental noise is annoyance. However, the response of individuals to similar noise events is diverse and influenced by the type of noise, the perceived importance of the noise and its appropriateness in the setting, the time of day, and the type of activity during which the noise occurs as well as the sensitivity of the individual. Therefore, the “A-weighted” noise scale, which corresponds to the audible frequencies to which humans are sensitive, is used for measurements. Noise levels using A-weighted measurements are typically written as “dB(A).”

In the United States, several noise metrics have been developed to describe noise levels depending on the character of the noise. Average noise levels over a period of minutes or hours are usually expressed as dB L_{eq} , the equivalent noise level. The period of time average may be specified; $L_{eq(3)}$ would be a 3-hour average, for example. For continuous noise sources such as roadways, noise levels are often averaged over a period of 24 hours, and are normally weighted to account for greater human sensitivity to noise in the evening and nighttime hours. These 24-hour noise metrics are used to establish community noise equivalent levels, and day and nighttime levels.

3.3.3 Existing Conditions

The HGLA is located in a relatively remote desert region of Inyo County dominated by mostly undeveloped federal and state lands. Current uses within this area include recreation, residential, ranching, and mining. The nearest potentially noise-sensitive residential and recreational receptors to the HGLA are sparsely populated areas in Haiwee, areas to the south of Haiwee at Dunmovin and Coso Junction, and the Enchanted Lake Village and the Haiwee Reservoirs, located north of the HGLA. Sensitive noise receptors are, in general, those areas of human habitation or substantial use where the intrusion of noise has the potential to adversely impact the occupancy, use, or enjoyment of the environment. Receptors can include residences, schools, hospitals, parks, trails and other miscellaneous recreational areas, and places of business requiring low levels of noise. Because the BLM-administered lands within the HGLA are situated in a very remote area, sensitive human receptors in or near the HGLA are unlikely.

Ambient noise level measurements for the HGLA are not available. However, based on the existing land uses and environmental conditions, ambient noise levels in the HGLA and vicinity are generally assumed to be low and representative of remote desert areas (i.e., 35 to 50 dB(A)). Potential exceptions due to intermittent noise-generating activities in the vicinity include:

- Noise associated with occasional recreational and support activities in the HGLA and immediate vicinity.
- Noise associated with mining and mineral transport in the HGLA and immediate vicinity.
- Ambient vehicular traffic noise from nearby US 395.
- Periodic noise from mission operations at the nearby China Lake NAWS.
- Noise from off-highway vehicles (OHV) (e.g. motorcycles up to 100 dB(A)).

3.4 TOPOGRAPHY, GEOLOGY AND SEISMICITY

3.4.1 Applicable Regulations, Plans, Policies/Management Goals

The Federal Land Policy and Management Act (FLPMA) and the California Desert Conservation Area (CDCA) Plan, as amended, contain most of the relevant resource management approaches, policies and management goals addressing these resources. The FLPMA states:

“...responding to national priority needs for resource use and development, both today and in the future, including such paramount priorities as energy development and transmission, without compromising the basic desert resources of soil, air, water, and vegetation, or public values such as wildlife, cultural resources, or magnificent desert scenery.”

The most applicable management goal of the CDCA Plan is the identification of potential sites for development of geothermal, wind, and solar generating facilities. The Plan’s general goals for Geology-Energy-Minerals (G-E-M) resources are to:

- (1) Within the multiple-use management framework, assure the availability of known mineral resource lands for exploration and development.
- (2) Encourage the development of mineral resources in a manner which satisfies national and local needs, and provides for economically and environmentally sound exploration, extraction, and reclamation processes.

- (3) Develop a mineral resource inventory, G-E-M database, and professional, technical, and managerial staff knowledgeable in mineral exploration and development.

3.4.2 Affected Environment

3.4.2.1 Topography

The surface elevation of Rose Valley ranges from 3,200 feet near Little Lake to the south to 3,750 feet near South Haiwee Reservoir to the north. The northern boundary of the valley is formed by merging alluvial fans that descend from the two bounding mountain ranges. Peaks in this portion of the Sierra Nevada Range rise to more than 9,000 feet, and peaks in the Coso Range rise to more than 6,000 feet.

The ground surface of the valley floor generally slopes gently to the south at a rate of 30 to 35 feet per mile. The HGLA is divided nearly equally between the low-lying valley and the higher elevation of the Coso Range. At its lowest point to the south, the HGLA lies 3,300 feet above sea level. The HGLA extends west to 4,200 feet in the Sierra Nevada foot hills, and to above 5,700 feet in the Coso Range to the east. To the north of the HGLA, the Coso Range elevations reach 6,085 feet, and valley elevations average nearly 3,700 feet.

3.4.2.2 Geology

Regional Geology

The HGLA is located at the transition between the extensional Basin and Range geomorphic province and the Eastern California Shear Zone. Geologic units in the vicinity are shown in Figure 3.4-1. The Basin and Range structural province in this area is characterized by northerly trending normal fault block mountains (the Sierra Nevada range to the west and Coso Range to the east) separated by deep alluvial graben valleys. It is an area of high geothermal heat flow and general east-west crustal extension.

The oldest rock exposed in the western Basin and Range province is complexly folded Precambrian, low to middle grade metasediments and metavolcanics (Rockwell 1980). These are intruded by Jurassic to late Cretaceous stocks and plugs. The intrusives range in composition from gabbro to granite, with quartz-monzonite and granodiorite predominating. These small intrusive bodies are believed to be related to, or satellites of, the Sierra Nevada batholith.

The Sierra Nevada batholith is a large continuous exposure of plutonic rocks that represents the exhumed root zone of a subduction-related magmatic arc. The magmatic arc was continuously active for more than 140 million years; however, most crustal magmatism took

place during two short-lived episodes, one in the Late Jurassic and a second, more voluminous episode, in the Cretaceous (Ducea 2001). Granitic rocks of the Sierra Nevada Batholith form the core of the Sierra Nevada, Coso Range, and Argus Range (southeast of the Coso Range), and probably underlie the basement fill of Rose Valley. The Coso and Argus Ranges are primarily composed of various plutons of Jurassic quartz monzonites and granites.

The Mesozoic igneous and metamorphic core of the Coso Range is overlain by late Cenozoic volcanics that occurred in two periods. Older bimodal (basaltic and rhyolitic) volcanic eruptions are overlain by younger rhyolitic domes and related flows, and pyroclastic deposits. The youngest of these comprises Sugarloaf Mountain in the Coso Geothermal Field. This volcanism also reaches the eastern edge of the HGLA. The source of the younger volcanics appears to be a crystal magma reservoir that lies beneath the center of the Coso geothermal field (Wilson, et al. 2003).

Local Geology

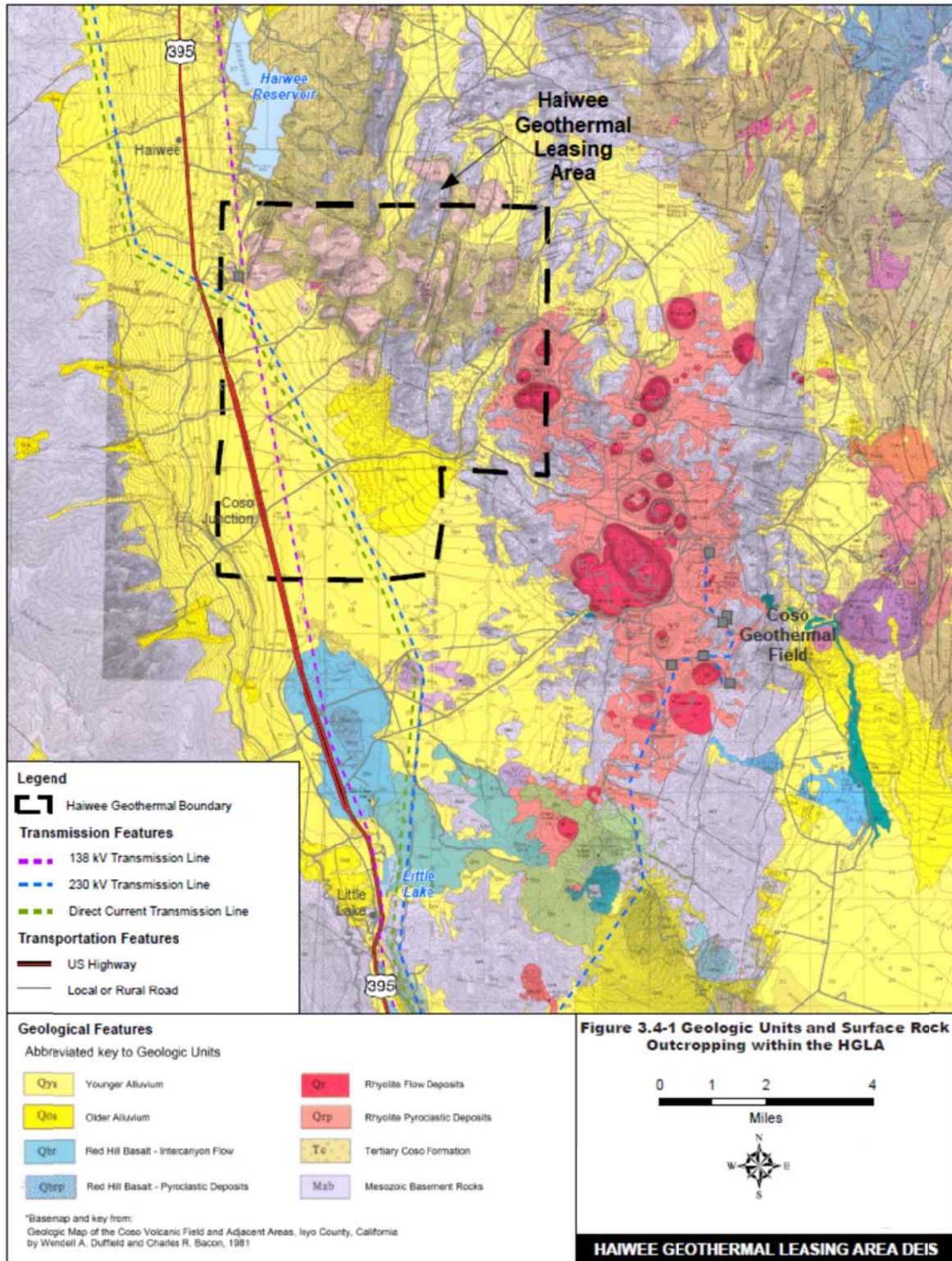
The HGLA includes two primary geomorphic provinces: Rose Valley and the Coso Range. The specific rock types and stratigraphy, and the structure and faulting of each area, are described below.

Rose Valley is a *graben* surrounded and underlain by igneous and metamorphic basement rocks of the Sierra Nevada and Coso Ranges, and filled with locally derived sediments and minor volcanics. The depth of sediment accumulation also reflects the vertical displacement along the valley-bounding faults.

Alluvial sediments were encountered to depths as great as 3,489 feet in borings in the north central portion of the basin (Schaer 1981), and may extend to depths greater than 5,000 feet below ground surface (bgs) based on gravity surveys (GeoTrans 2004). Outcrops east of the central and northern Rose Valley are younger volcanic rocks (30 to 0.4 million year-old) of the Coso Range and are predominately rhyolitic, dacitic, and andesitic in composition.

The southern boundary of the Rose Valley groundwater basin is marked by outcrops of volcanic rocks related to eruptions within, or to flows from the Coso Range and volcanic cinder cones in the Red Hill area. The flows, which form the eastern boundary of Little Lake, came from a vent on the southwest edge of the Coso Range. (Refer to Figure 3.4-1)

Figure 3.4-1 Geologic Units and Surface Rock Outcropping within the HGLA



3.4.2.3 Tectonic and Seismic Setting

The HGLA is located in an tectonically active transitional zone between the normal faulting extension characteristic of the Basin and Range Province to the north and east, and the north and west-southwest oriented strike-slip faulting of the Eastern California right lateral shear zone, represented by the Garlock fault to the south. This active tectonic stress is characterized by localized crustal extension in a releasing step-over fault between two major strike slip faults, and may act as an accommodation zone between the two tectonic regimes (Wilson, et al. 2003). Earthquakes are generated as a result of the tectonic stress, and the region in which the HGLA is located is one of the most seismically active in California.

This complex seismotectonic setting has produced a series of active faults within the vicinity of the HGLA. The faulting pattern in the area is related to the transitional tectonics. Faulting in the Coso Range is dominated by north to northeast striking normal faults, or right-lateral oblique-slip extensional faults with limited surface expression. Major faults in the vicinity include the Owens Valley Fault, the Sierra Nevada Fault Zone, the Little Lake Fault and the Airport Lake Fault (Figure 3.4-2).

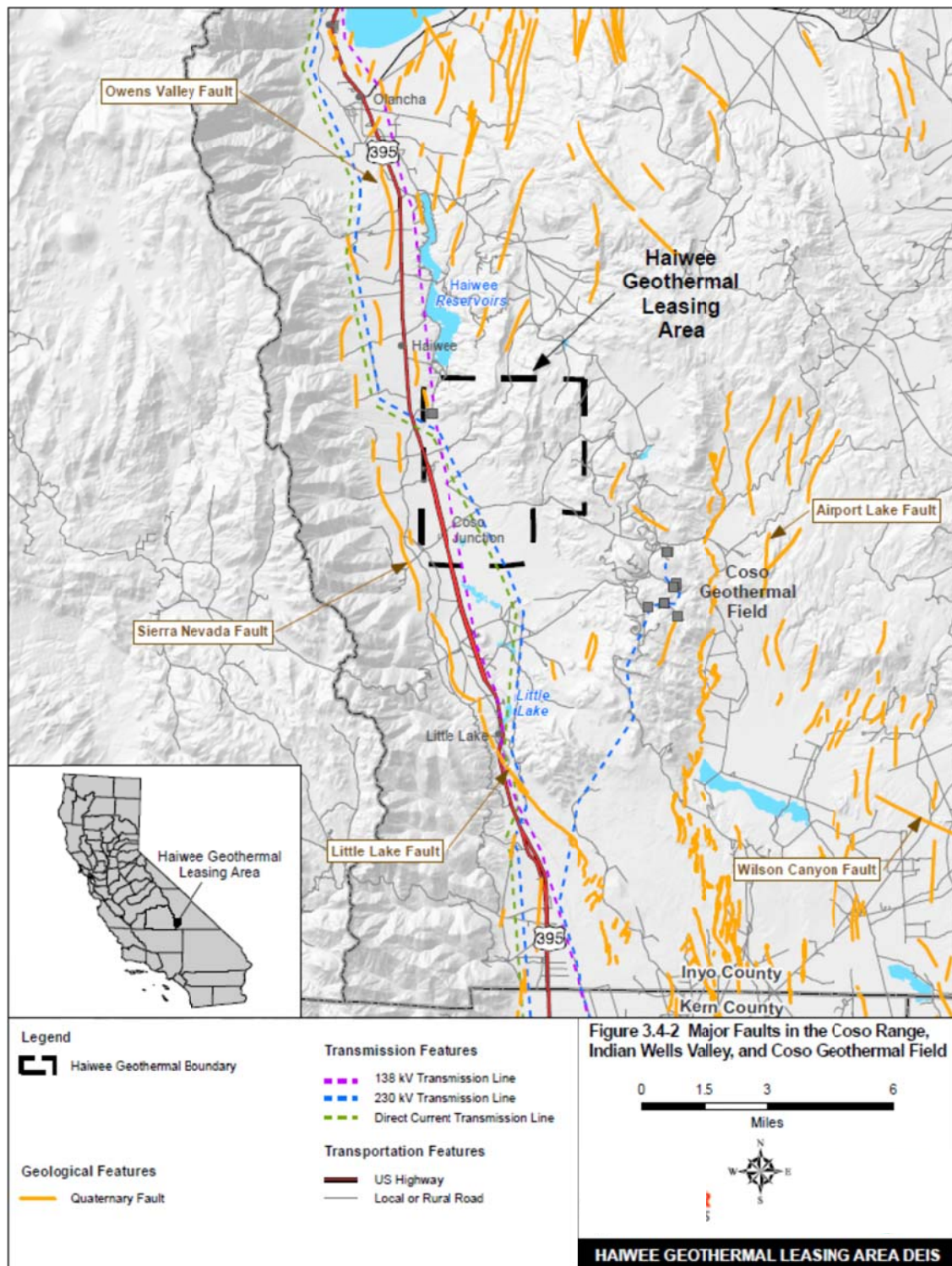
Seismic interpretation of local earthquake data (Unruh, et al. 2001) indicates this extension of brittle granitic rocks generates permeability within the geothermal field. This brittle fractured zone is underlain at 2.5 to 3.1 miles beneath the surface by the transition from brittle to ductile extension. Related magmatism provides the heat source for the actively exploited geothermal field at Coso, southeast of the area of interest.

The crustal structure, recent volcanism combined with geochemical data (Christenson, et al. 2007) suggests the presence of a rhyolitic magma chamber at the boundary between brittle rocks and ductile rocks at 2.5 to 3.8 miles beneath the surface (Bhattacharyya and Lees 2002). This semi-liquid zone erupted to form the most recent rhyolitic domes in the Southern Coso Range, and probably provides the heat source for the Coso hydrothermal system. Some seismic evidence suggests that this magma chamber may now be limited to the area underlying the currently exploited Coso geothermal area and may not extend under the rest of the Coso Range, Rose Valley, or Indian Wells Valley.

Seismicity-Earthquakes

Seismic activity in the form of micro-earthquakes can be induced by geothermal production (Feng and Lees 1998). However, given the natural background of seismicity, it is difficult to associate specific events with geothermal activities. Recent work indicates that injection can induce micro earthquakes at Coso of low magnitude ($M=0.3-2.6$) (Julian, et al. 2009).

Figure 3.4-2 Major Faults in the Coso Range, Indian Wells Valley, and Coso Geothermal Field



Most earthquakes in the Coso-Rose Valley-Indian Wells Valley region are small, with a magnitude (M) of <3.0. Large earthquakes (M>4.9) have been recorded about every 20 years until 1995 (1938, 1961, 1982, and 1995) with the most recent being the 1995 “Ridgecrest” Earthquake which occurred on the Airport Lake fault. After 1995, four major earthquakes have occurred in the region. These large earthquakes are related to fault movement. Most earthquakes within the geothermal field are smaller. Until 2002, the largest recorded event within the geothermal field was M=3.5 that occurred on May 10, 1998; it was probably related to the large Coso Range earthquake at the same time. Seismicity in both Indian Wells Valley and the Coso Range has increased since the major earthquakes of the mid-1990s.

Magmatism

The southern Coso Range includes a young volcanic zone containing volcanic domes and flows 4,000,000 to 40,000 years old. The youngest of these is a rhyolite dome known as Sugarloaf Mountain, located southeast of the HGLA. Geophysical data indicates that partially molten magma remains 2.5 to 3.8 miles (Wilson 2003; Bhattacharyya and Lees 2002) beneath these features.

The Coso Peak is identified by the U.S. Geological Survey (USGS) as a potentially active volcanic area based on the presence of the hydrothermal system and seismic activity (<http://vulcan.wr.usgs.gov/Volcanoes/California/Coso/framework.html>). The USGS considers the area subject to volcanic hazards from potential future production (Miller 1989).

3.5 SOILS

3.5.1 Applicable Regulations, Plans, Policies / Management Goals

The CDCA Plan’s goals potentially applicable to soils are similar to those stated for geology and minerals resources, above. They are as follows:

- Within the multiple-use management framework, assure the availability of known mineral resource lands for exploration and development.
- Encourage the development of mineral resources in a manner which satisfies national and local needs, and provides for economically and environmentally sound exploration, extraction, and reclamation processes.
- Develop a mineral resource inventory, G-E-M database, and professional, technical, and managerial staff knowledgeable in mineral exploration and development.

The Code of Federal Regulations further specifies that, at a minimum, soils must be managed to maintain vegetative cover, soil moisture, and permeability rates appropriate for the soils, climate, and land forms found at their location. (43 CFR 4180.2(e) and (f))

3.5.2 Affected Environment

Soils data are not available for the entire HGLA. The Soils Technical Report previously prepared for the Coso Geothermal Study Area (Rockwell 1980), provides soils data for 63 percent of the HGLA. The area surveyed for the Coso Soils Technical Report does not include the northern portion of the HGLA in the vicinity of the Haiwee Reservoir. However, it is reasonable to assume that the soils in the area to the north (not included in the Coso Report) are generally similar to the soils included in the Coso Report because of similarities between geologic units and landforms in the two directly adjacent areas.

3.5.2.1 Haiwee Reservoir Soils

A general description of the soils surrounding the Haiwee Reservoir is provided in the “Draft Progress Report: “Total Maximum Daily Load for Copper for the Haiwee Reservoir” prepared by the California Regional Water Quality Board (2001). The soils on the western slope of the Haiwee Reservoir are derived from metasedimentary, metavolcanic and pyroclastic rocks, and alluvium from granitic rocks of the Sierra Nevada. The slopes range from two to 15 percent, with some slopes as steep as 75 percent closer to the Sierra range front. The soils are generally described as sandy loam, gravelly and or loamy sand, and cobbly sandy clay loam. Portions of the soils are classified as being very shallow to shallow in depth (5 to 20 inches), while the majority of the soil surrounding the western portion of the reservoir is classified as very deep (60 inches or greater). These very deep soils occur in the two to 15 percent slope areas, and are considered well drained with moderately slow permeability and runoff with a slight hazard of erosion by water. The shallow soils occur in the steeper slopes and are classified as excessively drained with rapid runoff potential and therefore severe hazard of erosion by water.

Soils form alluvial fan terraces on the eastern side of the Haiwee Reservoir. The slopes range from two to nine percent with 20 to 35 percent vegetative cover. The soils are classified as moderately deep to very deep, well drained soils that have slow to medium surface runoff potential and a slight hazard of erosion by water. Loamy sand, sand, and gravelly/cobbly loamy coarse sand are the general soil textural classifications that occur on the eastern flank of the reservoir. Localized portions of the soils on the eastern side are loamy coarse sands that occur on steeper slopes with rapid to very rapid surface runoff potential (Natural Resources Conservation Service [NRCS] 2001).

The types of soils found in the southern portion of the Haiwee Reservoir area include the following units:

- **Cajon:** Somewhat excessively drained soils formed in alluvium derived from granite. They are subject to water and wind erosion. The depth to a root restrictive layer is greater than 60 inches.
- **Helendale-Cajon Complex:** Well drained to somewhat excessively drained, formed in alluvium derived from granite. They are subject to water and wind erosion. The depth to a root restrictive layer is greater than 60 inches.
- **Lithic Torriorthents-Badland Complex:** Somewhat excessively drained soils formed in residuum weathered from metavolcanics and/or metasedimentary rock and/or granite. They are subject to water and wind erosion. The depth to a root restrictive layer is three to 20 inches.
- **Neuralia-Timosea-Typic Argidurids Complex:** Well drained soils formed in alluvium derived from granite. They are subject to water and wind erosion. The depth to a root restrictive layer is 20 to greater than 60 inches.

The soils of the Haiwee reservoir area, and their limiting characteristics, are described in Table 3.5-1.

Table 3.5-1 Limiting Characteristics of Haiwee Reservoir Soil Map Units

Soil Map Unit	Unstable –			Expansive
	Cave-in Potential	Shrink-Swell Potential	Slope \geq 15%	
Cajon loamy sand, stratified substratum, 0 to five percent slopes.	X	-	-	-
Helendale-Cajon complex, 0 to five percent slopes.	X	-	-	-
Lithic Torriorthents-Badland complex, 15 to 75 percent slopes.	X	-	X	-
Neuralia-Timosea-Typic Argidurids complex, two to 15 percent slopes.	X	X	X	X

(USDA 2010)

3.5.2.2 Coso Area Soils

Soils in the Coso area are generally coarse and rocky. They are derived from either the bedrock substrate or basement rocks in the Coso Range that consist of granitic rocks of Mesozoic age with older metasedimentary and metavolcanic rocks. The Sugarloaf Mountain area exhibits overlapping volcanic domes and flows with extensive obsidian outcrops. The types of soils found in the Coso area include the following (BLM 1980; MHA 2008):

- **Dunmovin:** Somewhat excessively drained, deep, sandy soils formed in alluvium. They are subject to water and wind erosion.
- **Dunmovin-Lavic-Wasco Variant:** Sandy and loamy soils, excessively to well drained, very deep, and formed in alluvium. They have a high potential for wind erosion and are susceptible to water erosion.
- **Alko Variant-Joshua Variant-Nebona Variant:** Shallow to deep, generally sandy and loamy with some clay lenses and silica-cemented hardpans. These soils are well drained and susceptible to wind and water erosion.
- **Maynard Lake-Stumble:** Sandy soils formed in alluvial plains from rhyolite tuff and volcanic ash deposits. These soils are highly porous and drain rapidly. They are subject to moderate water erosion and high wind erosion.
- **Coso-Rock Outcrop:** Shallow to very shallow units formed in granite outcrops. These soils are stony and loamy, and are excessively drained due to rapid runoff. They are highly susceptible to water and wind erosion.

The Coso area soils, and their general characteristics resented in Table 3.5-2.

Table 3.5-2 Limiting Characteristics of Coso Soil Map Units

Soil Map Unit	Unstable –			Expansive
	Cave-in Potential	Shrink-Swell Potential	Slope $\geq 15\%$	
Arizo very bouldery loamy sand, 2 to 5 percent slopes.	-	-	-	-
Coso – Rock outcrop – Haiwee complex, 30 to 50 percent slopes.	-	-	X	-
Coso – Rock outcrop – Coso Variant association, steep.	-	-	X	-

Soil Map Unit	Unstable –			Expansive
	Cave-in Potential	Shrink-Swell Potential	Slope ≥ 15%	
Dunmovin loamy coarse sand, 0 to 5 percent slopes.	X	-	-	-
Dunmovin loamy, coarse sand, 5 to 9 percent slopes.	X	-	-	-
Dunmovin bouldery loamy coarse sand, 5 to 9 percent slopes.	X	-	-	-
Dunmovin – Lavic complex, 0 to 2 percent slopes.	X	X	-	-
Dunmovin Variant – Nebona Variant – Alko Variant complex, 2 to 9 percent slopes.	-	X	-	X*
Hooten Variant bouldery loamy fine sand, 5 to 15 percent slopes.	-	-	-	-
Hooten Variant loamy fine sand, 5 to 9 percent slopes.	-	-	-	-
Joshua Variant – Arizo – Lavic complex, 2 to 5 percent slopes.	-	X	-	-
Lavic – Dunmovin – Playa association, nearly level.	X	X	-	-
Maynard Lake loamy coarse sand, 15 to 30 percent slopes.	X	-	X	-
Maynard Lake loamy coarse sand, 2 to 15 percent slopes.	X	-	X	-
Nebona Variant – Alko Variant cobbly loamy sands, 5 to 30 percent slopes.	-	X	X	X*
Rock outcrop – Haiwee Variant complex, 30 to 50 percent slopes.	-	-	X	X*
Rubble land – Torriorthents – Rock outcrop complex, 30 to 75 percent slopes.	-	-	X	-
Shoken-Rock outcrop association, steep Shoken stony sandy loam, 30 to 50 percent slopes.	-	-	X	-
Stumble loamy coarse sand, 15 to 30 percent slopes.	X	-	X	-
Stumble loamy coarse sand, 2 to 15 percent slopes.	X	-	X	-
Stumble loamy coarse sand, 30 to 50 percent slopes.	X	-	X	-
Wasco Variant very fine sandy loam, 0 to 2 percent slopes.	-	-	-	-

*Soil map units meet the first two criteria required to be considered expansive; insufficient data available to determine whether third criteria is met.

(Rockwell International 1980)

Soil erodibility is taken into consideration during the planning and designing stages for future projects. The erodibility of the soils within the Coso area ranges from slight to high (see Tables 3.5-3 and 3.5-4). A rating of “slight” indicates that the surface layer texture is typically clay that holds together, is thicker than 40 inches, and occurs on slopes of less than 15 percent. A moderate rating indicates that the surface layer texture is clay loam, loam, or sandy loam that holds together moderately well, is between 20 and 40 inches thick, and occurs on slopes of between 15 percent and 30 percent. A high rating is given to soils when the surface layer texture is sand or loamy sand that is weakly held together, is less than 20 inches thick, and lies on slopes of greater than 30 percent (SDG&E 2006).

Table 3.5-3 Haiwee Reservoir Soil Types and Characteristics

Soil Map Unit	Hydrologic Group*	Soil	Kf (Water Erosion Factor)**	Wind Erodibility Group***
Cajon loamy sand, stratified substratum, 0 to 5 percent slopes.	Cajon: A		Cajon: .17	Cajon: 2
Helendale-Cajon complex, 0 to 5 percent slopes.	Helendale: B Cajon: A		Helendale: .20 Cajon: .17	Helendale: 2 Cajon: 2
Lithic Torriorthents-Badland complex, 15 to 75 percent slopes.	Lithic Torriorthents: C Badland: D		Lithic Torriorthents: .20 Badland: -	Lithic Torriorthents: 3 Badland: 8
Neuralia-Timosea-Typic Argidurids complex, 2 to 15 percent slopes.	Nerualia: B Timosea: B Typic Argidurids: C		Neuralia: .20 Timosea: .20 Typic Argidurids: .24	Neuralia: 3 Timosea: 3 Typic Argidurids: 4

Source: NRCS 2010.

*Hydrologic soil groups are based on estimates of runoff potential. Group A has low runoff potential, and Group D has high runoff potential.

**Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

***The soils assigned to wind erodibility Group 1 are the most susceptible to wind erosion, and those assigned to Group 8 are the least susceptible.

Table 3.5-4 Coso Soil Types and Characteristics

Soil Map Unit	Inclusions	Runoff	Hazard of Water Erosion	Hazard of Soil Blowing
Arizo very bouldery loamy sand, 2 to 5 percent slopes.	<ul style="list-style-type: none"> Dunmovin bouldery loamy coarse sand Other soils 	Slow	Slight	
Coso – Rock outcrop – Haiwee complex, 30 to 50 percent slopes.	<ul style="list-style-type: none"> Coso Variant Typic Haplargids, fine, mixed, thermic Typic Camborthids, loamy-skeletal, mixed, thermic 	Medium to Rapid	High	
Coso – Rock outcrop – Coso Variant association, steep.	<ul style="list-style-type: none"> Haiwee very stony sandy loam Typic Haplargids, fine, mixed, thermic Typic Camborthids, loamy- 	Medium to Rapid	Moderate to High	
<ul style="list-style-type: none"> Coso stony sandy loam, 15 to 50 percent slopes. Rock outcrop. 				

Soil Map Unit	Inclusions	Runoff	Hazard of Water Erosion	Hazard of Soil Blowing
<ul style="list-style-type: none"> Coso Variant very stony sandy loam, 15 to 30 percent slopes. 	skeletal, mixed, thermic			
Dunmovin loamy coarse sand, 0 to 5 percent slopes.	<ul style="list-style-type: none"> Typic Torriorthents, coarse-loamy, mixed, thermic Lavic loamy sand 	Very Slow to Slow		High
Dunmovin loamy, coarse sand, 5 to 9 percent slopes.	<ul style="list-style-type: none"> Dunmovin bouldery loamy coarse sand Arizo gravelly loamy sand Dunmovin Variant loamy sand 	Slow to Medium	Slight to Moderate	High
Dunmovin bouldery loamy coarse sand, 5 to 9 percent slopes.	<ul style="list-style-type: none"> Dunmovin gravelly loamy sand Arizo gravelly loamy sand 	Slow to Medium	Slight to Moderate	High
Dunmovin – Lavic complex, 0 to 2 percent slopes. <ul style="list-style-type: none"> Dunmovin loamy coarse sand, 0 to 2 percent slopes. Lavic loamy sand, 0 to 2 percent slopes. 	<ul style="list-style-type: none"> Riverwash Typic Torriorthents, coarse-loamy mixed thermic 	Very Slow	Slight	High
Dunmovin Variant – Nebona Variant – Alko Variant complex, 2 to 9 percent slopes. <ul style="list-style-type: none"> Dunmovin Variant loamy sand, 2 to 9 percent slopes. Nebona Variant cobbly loamy sand, 2 to 9 percent slopes. Alko Variant cobbly loamy sand, 2 to 9 percent slopes. 	<ul style="list-style-type: none"> Joshua Variant sandy loam Dunmovin loamy coarse sand 	Slow to Medium	Slight to Moderate	High
Hooten Variant bouldery loamy fine sand, 5 to 15 percent slopes.	<ul style="list-style-type: none"> Dunmovin bouldery loamy coarse sand Hooten Variant loamy fine sand 	Slow to Medium	Slight to Moderate	High
Hooten Variant loamy fine sand, 5 to 9 percent slopes.	<ul style="list-style-type: none"> 	Slow to Medium	Slight to Moderate	High
Joshua Variant – Arizo – Lavic	<ul style="list-style-type: none"> Nebona Variant 	Very	Slight	Moderate

Soil Map Unit	Inclusions	Runoff	Hazard of Water Erosion	Hazard of Soil Blowing
complex, 2 to 5 percent slopes. <ul style="list-style-type: none"> Joshua Variant sandy loam, 2 to 5 percent slopes. Arizo very bouldery loamy sand, 2 to 5 percent slopes. Lavic loamy sand, 2 to 5 percent slopes. 	<ul style="list-style-type: none"> Alko Variant 	Slow to Slow		to High
Lavic – Dunmovin – Playa association, nearly level. <ul style="list-style-type: none"> Lavic loamy sand, 0 to 2 percent slopes. Dunmovin loamy coarse sand, 0 to 2 percent slopes. Playa 	<ul style="list-style-type: none"> Typic Camborthids, loamy-skeletal, mixed, thermic Typic Torriorthents, fine-silty, mixed, thermic 	Very Slow	Slight	High
Maynard Lake loamy coarse sand, 15 to 30 percent slopes.	<ul style="list-style-type: none"> Maynard Lake loamy coarse sand (over-welded tuff at 40 to 60 inches depth) Coso stony sandy loam 	Medium	Moderate	High
Maynard Lake loamy coarse sand, 2 to 15 percent slopes.	<ul style="list-style-type: none"> Dunmovin loamy coarse sand 	Slow to Medium	Slight to Moderate	High
Nebona Variant – Alko Variant cobbly loamy sands, 5 to 30 percent slopes. <ul style="list-style-type: none"> Nebona Variant cobbly loamy sand, 5 to 30 percent slopes. Alko Variant cobbly loamy sand, 5 to 30 percent slopes. 	<ul style="list-style-type: none"> Dunmovin cobbly loamy sand, 2 to 9 percent slopes Joshua Variant Torriorthents cobbly loamy sands Hardpans at less than 8 inches depth 	Medium to Rapid	Moderate to High	
Rock outcrop – Haiwee Variant complex, 30 to 50 percent slopes. <ul style="list-style-type: none"> Rock outcrop. Haiwee Variant very stony loam, 30 to 50 percent slopes. 	<ul style="list-style-type: none"> Typic Torriorthents, loamy-skeletal, mixed, mesic Stumble loamy coarse sand (over andesitic tuff at 20 to 60 inches depth) 	Medium to Rapid	High	
Rubble land – Torriorthents – Rock outcrop complex, 30 to 75 percent slopes. <ul style="list-style-type: none"> Rubble land Torriorthents Rock outcrop 	<ul style="list-style-type: none"> Maynard Lake loamy coarse sand (over welded tuff at 20 to 60 inches depth) 	Medium to Rapid	Moderate to High	

Soil Map Unit	Inclusions	Runoff	Hazard of Water Erosion	Hazard of Soil Blowing
Shoken-Rock outcrop association, steep Shoken stony sandy loam, 30 to 50 percent slopes. • Rock outcrop	<ul style="list-style-type: none"> • Lithic Torriorthents, loamy-skeletal, mixed, mesic • Typic Haplargids, fine, mixed, mesic • Typic Camborthids, loamy-skeletal, mixed, mesic 	Medium to Rapid	Moderate to High	Moderate
Stumble loamy coarse sand, 15 to 30 percent slopes.	<ul style="list-style-type: none"> • Stumble loamy coarse sand (over-welded tuff at 40 to 60 inches depth) • Shoken stony sandy loam 	Medium	Moderate	High
Stumble loamy coarse sand, 2 to 15 percent slopes.	<ul style="list-style-type: none"> • Haybourne loamy sand, 2 to 15 percent slopes • Playa 	Slow to Medium	Slight to Moderate	High
Stumble loamy coarse sand, 30 to 50 percent slopes.	<ul style="list-style-type: none"> • Stumble loamy coarse sand (over-welded tuff at 20 to 60 inches depth) • Shoken stony sandy loam 	Medium to Rapid	High	High
Wasco Variant very fine sandy loam, 0 to 2 percent slopes.	<ul style="list-style-type: none"> • Dunmovin loamy coarse sand 	Very Slow	Slight	Moderate

Source: Rockwell 1980

3.6 WATER RESOURCES

3.6.1 Applicable Regulations, Plans, Policies/Management Goals

A number of state, federal, and regional regulations, policies, and plans are potentially applicable to surface and groundwater development at the HGLA and in Rose Valley. The CDCA multiple use class guidelines state that BLM land will be managed to provide for the protection and enhancement of surface and groundwater resources, except for instances of short-term degradation caused by water development projects, and states that best management practices will be used to avoid degradation and to comply with Executive Order 12088 (Oct. 13, 1978). Also at the federal level, Executive Order 12088 requires compliance with the federal Clean Water Act (CWA) which regulates the discharge of pollutants to waters of the United States from any point source. Section 402(p) amended the CWA and established a framework for regulating non-point source storm water discharges under the National Pollutant Discharge Elimination System (NPDES) program. In California, the

NPDES Stormwater Program is administered by the California Regional Water Quality Control Boards.

At the state level the HGLA lies within the jurisdiction of the Lahontan office of the Regional Water Quality Control Board (LRWQCB) which administers the Water Quality Control Plan (Basin Plan) for protection of beneficial uses of surface and groundwater of this part of the state. The Basin Plan sets forth water quality standards for the surface and ground waters of the Region, which include both designated beneficial uses of water and the narrative and numerical objectives which must be maintained or attained to protect those uses. It identifies required or recommended control measures for water quality problems. In some cases, it prohibits certain types of discharges in particular areas. The Plan summarizes applicable provisions of separate State Board and Regional Board planning and policy documents (e.g., the Regional Board waiver policy), and of water quality management plans adopted by other federal, state, and regional agencies.

At the local level the Inyo County General Plan (Inyo County 2001), Conservation and Open Space Element, identifies goals and policies relevant to hydrology and water quality. Relevant goals and policies from the Inyo County General Plan include:

- WR-1--Provide an adequate and high quality water supply to all users within the County. Its corresponding regulatory Compliance Policy WR-1.4 states: Continue the review of development proposals and existing uses to the requirements of the Clean Water Act, LRWQCB, and local ordinances to reduce polluted runoff from entering surface waters.
- WR-2--Protect and preserve water resources for the maintenance, enhancement, and restoration of environmental resources. Policy WR-2.1 requires Restoration: Encourage and support the restoration of degraded surface water and groundwater resources.
- WR-3--Protect and restore environmental resources from the effects of export and withdrawal of water resources. Corresponding policy WR-3.2 addresses Sustainable Groundwater Withdrawal: The County shall manage the groundwater resources within the County through ordinances, project approvals and agreements, ensure adequate, safe and economically viable groundwater supply for existing and future development within the County, protect existing groundwater users, maintain and enhance the natural environment, protect the overall economy of the County, and protect groundwater and surface water quality and quantity.

In addition, the BLM has designated the HGLA as Multiple-Use Class L: Limited Use. Multiple-use class guidelines are provided for each class in the CDCA Plan, and govern the

type and degree of land-use actions allowed within the HGLA. Water quality guidelines for Class L areas state that “areas designated in this class will be managed to provide for the protection and enhancement of surface and groundwater resources, except for instances of short-term degradation caused by water development projects. As such, best management practices, developed by the BLM during the planning process outlined in the Clean Water Act, Section 208, et seq., will be used to avoid degradation and to comply with Executive Order 12088.”

Most wetland and riparian areas also represent jurisdictional surface waters. The corresponding guidelines for Class L areas state that “Wetland/riparian areas will be considered in all proposed land-use actions. Steps will be taken to provide that these unique characteristics and ecological requirements are managed in accordance with Executive Order 11990, Protection of Wetlands (42 CFR 26951), legislative and Secretarial direction, and BLM Manual 6740: ‘Wetland Riparian Area Protection and Management’” (BLM 1979).

The Vegetation Plan Element of the CDCA Plan also addresses wetlands such as seeps and springs, riparian zones, and mesquite thickets, among others. Wetland-riparian areas are to be considered in all proposed land use actions where appropriate and legally possible. Steps are to be taken to ensure their unique characteristics and ecological requirements are managed in accordance with legislative, Executive, and Secretarial directions. To the extent possible all actions are to avoid adverse impacts to wetland and riparian areas.

The CDCA Water Resources Program requires the analysis of water resources impacts of various activities, including the collection of sufficient data to conduct adequate analysis and the formulation of recommendations for avoiding or mitigating impacts.

3.6.2 Affected Environment

3.6.2.1 Surface Water Resources

The HGLA is located within the Indian Wells-Searles Valleys Watershed (HUC 18090205) in the Rose Valley basin on the east side of the Sierra Nevada. The area in the vicinity of the HGLA is further divided into five sub-watersheds: Haiwee Creek, Fine Canyon-Rose Valley, South Haiwee Reservoir, Cactus Flats, and Portuguese Canyon. The majority of the HGLA area falls within the Haiwee Creek sub-watershed. Generally water flow is from north to south within the paleo Owens River valley, with runoff contributing from the Sierra Nevada Mountains to the west and the Coso Range to the east.

The climate of the Rose Valley is greatly influenced by the Sierra Nevada Range. These mountains cause a rain shadow effect east of the Sierra crest, where precipitation on the valley floor is appreciably less than that west of the crest. Therefore, the climate in Rose

Valley is semi-arid to arid, and is characterized by low precipitation, abundant sunshine, frequent winds, and moderate to low humidity. According to data collected from 1923 to 2009 at the Haiwee Reservoir by the Western Regional Climate Center (WRCC), the average annual maximum temperature is 73°F, and the average annual minimum temperature is 46°F. Average total annual precipitation is 6.55 inches and average total annual snowfall is five inches (WRCC 2010).

Rose Valley and the HGLA receive runoff from the surrounding mountains, which flows underground into the valley and then south to Little Lake. In addition, several perennial spring-fed streams flow from the Sierra Nevada including Portuguese Canyon, Lewis Canyon, Tunawee Canyon, Talus Canyon, Johnson Canyon and Haiwee Creek. However, much of Haiwee Creek is diverted to the Los Angeles Aqueduct via water intakes. Intermittent streams also flow from the Coso Range located to the east. The alluvial fans from the Coso Range runoff converge and create the northern boundary of the Rose Valley basin. Rose Valley is topographically separated from the Owens Valley to the north and the Indian Wells Valley to the south. As a result, there are no perennial streams in Rose Valley except for the outfall channel from Little Lake at the south end of Rose Valley, intermittent streams in the highlands west of the valley, and the concrete-lined LADWP aqueduct along the west side of the valley.

South Haiwee Reservoir

The South Haiwee Reservoir is located at the north end of Rose Valley near the northwest corner of the HGLA (Figure 3.6-1). The LADWP owns and operates the Haiwee Reservoir as part of the Los Angeles Aqueduct system, which supplies drinking water to Los Angeles. The majority of water inflow to the Haiwee Reservoir is from the Los Angeles Aqueduct, which diverts water from the Mono Basin and Owens Valley. The South Haiwee Reservoir is separated from the North Haiwee Reservoir by an earthen berm called the Merrit Cut. Water from the North Reservoir flows south and can exit the reservoir through the Merrit Cut to the South Reservoir or through the Haiwee bypass channel to the second Los Angeles Aqueduct.

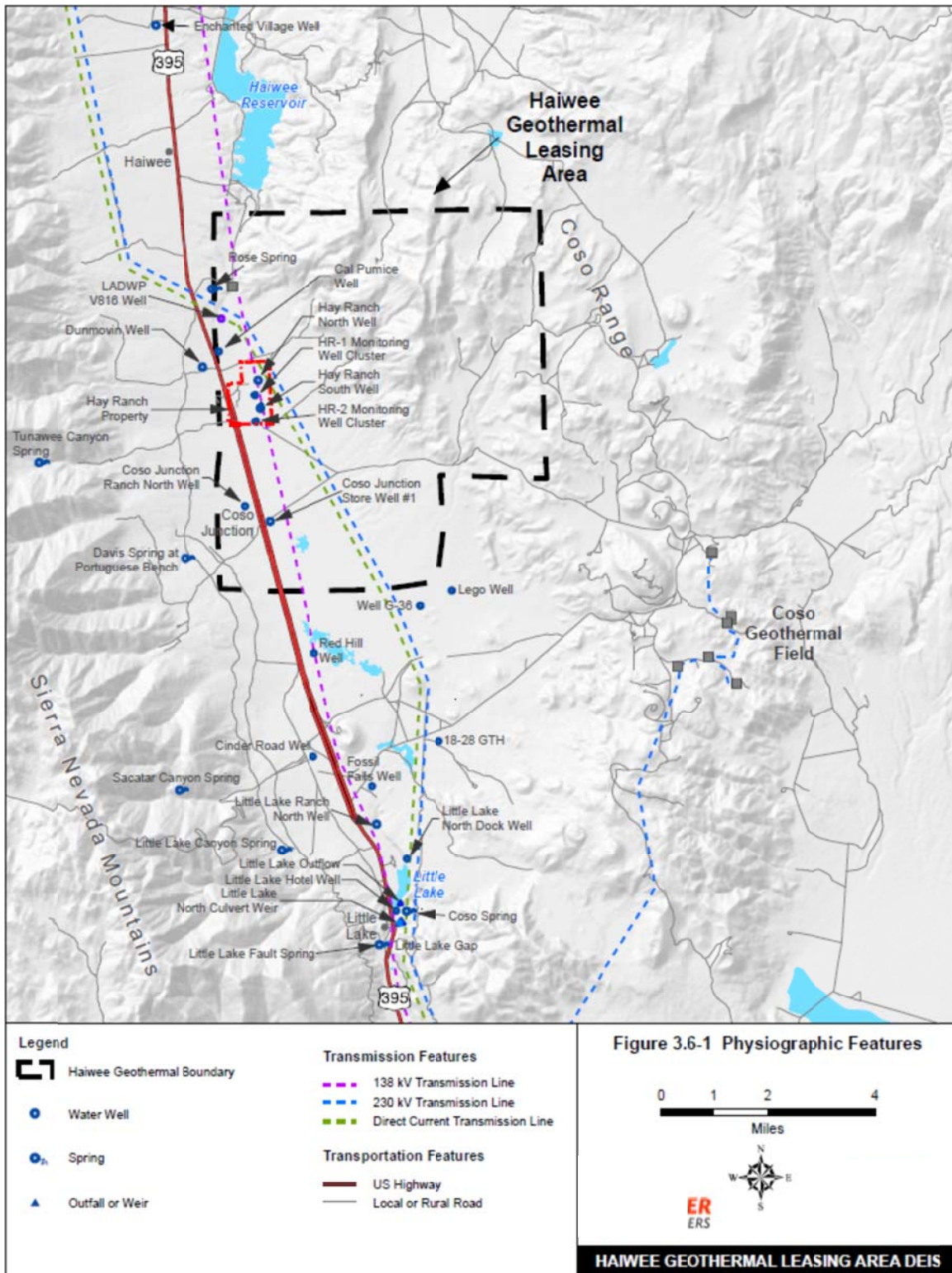
The South Haiwee Reservoir has a maximum storage of 46,600 acre-feet and, under normal operating conditions, a water surface area of 800 acres (LRWQCB 2001). Releases from the South Haiwee Reservoir flow south to the first Los Angeles Aqueduct. Water is also occasionally diverted to the second Los Angeles Aqueduct through a Y-branch just downstream of the South Reservoir. Both Los Angeles Aqueduct pipelines parallel the western boundary of the HGLA, and cross only a small portion of the latter. Seepage loss from the reservoir may provide additional inflow to the Rose Valley basin.

The crest of the South Haiwee Reservoir is located at 3,766 feet above mean sea level (amsl). Because of seismic stability concerns, the water level in the reservoir is currently limited to a

maximum elevation of 3,742 feet amsl. The water level in the reservoir stood at 3,730 feet amsl in November/December 2009 (LADWP 2009).

In addition to the Haiwee reservoirs, groundwater recharge comes chiefly from the percolation of runoff and infiltration of precipitation that falls to the valley floor. Alluvial fan deposits at the base of the Sierra Nevada serve as the principal areas for the percolation of runoff (CDWR 2004).

Figure 3.6-1 Physiographic Features of the Rose Valley



Springs

All springs described below are shown on Figure 3.6-1.

Rose Spring – Rose Spring is located in the HGLA two miles south and west of the South Haiwee Reservoir at an elevation of 3,640 feet amsl. The spring discharge data presented in Rockwell (1980) indicates that the spring was flowing in November 1975, but did not list discharge rate data for the spring. While the Rose Spring was reportedly sampled by the USGS in the early 1970's, no discharge has been observed from the spring in recent years. During a biological reconnaissance survey conducted on April 5, 2008, no surface water was observed at this spring. A concrete storage structure lies below the spring; however, water pipes that once fed the structure are no longer functioning (MHA 2008). When flowing, the spring apparently drains shallow groundwater in alluvial sediments south of the South Haiwee Reservoir and may receive some flow from the west. Due to its higher elevation and lack of current discharge, the Rose Spring is not believed to be directly connected to the Rose Valley groundwater aquifer system except as an ephemeral manifestation of inflow.

Tunawee Canyon Spring – Tunawee Canyon Spring is located in Tunawee Canyon four miles northwest of the town of Coso Junction at 5,200 feet amsl. Several springs are identified in the upper reaches of Tunawee Canyon on the USGS topographic map of the area. Tunawee Canyon Spring is likely sustained by high elevation precipitation infiltration in the Sierra Nevada Mountains to the west. Rockwell (1980) reported discharge rates of 1.6 to 15 gallons per minute (2.6 to 24 acre-feet/yr) from the spring in November 1975.

Davis Spring – The Davis Spring is located on the Davis Ranch, two miles west of Coso Junction. The Davis Spring is located on the west central side of Rose Valley at Portuguese Bench at an elevation of 3,870 feet amsl. The estimated groundwater discharge rate from the Davis Spring was reported to be seven acre-feet per year (ac-ft/yr) on an annualized basis in November/December 2007 (MHA 2008), and 9 ac-ft/yr in October/November 2009 (Inyo Co. 2009).

The Davis Spring discharge point is located more than 600 feet higher than the groundwater table in the Rose Valley aquifer east of the Davis property at Coso Junction. Spring flow is sustained by high elevation precipitation infiltration in the Sierra Nevada Mountains west of the Davis property. Discharge from the spring not used on the Davis property infiltrates back into the ground, after which it percolates downward to recharge the alluvial aquifer.

Sacatar and Little Lake Canyon Springs – Rockwell (1980) presents data from sampling springs in Sacatar Canyon and Little Lake Canyon in February 1979. The springs were reportedly located at elevations of 4,950 and 3,650 feet amsl, respectively. Sacatar Spring reportedly flowed at a rate of one to five gallons per minute (1.6 to 8 acre-feet/yr) in

November 1975. No flow rate data were identified for Little Lake Canyon Spring. Both springs are located in bedrock outcrops above and west of Rose Valley (Figure 3.6-1).

Little Lake Fault and Coso Springs – The Little Lake Fault Spring and Coso Spring are located at the south end of Rose Valley. Little Lake Fault Spring is located on the west side of US 395 one mile south of Little Lake. Coso Spring is located east of US 395, on the Little Lake Ranch property, about a quarter mile south of Little Lake. No data have been identified regarding the groundwater discharge rate from the Little Lake Fault Spring.

Coso Hot Springs are a key surface water resource in the vicinity of the HGLA. Although located more than 10 miles east-southeast from the HGLA, the Coso Hot Springs are included in this discussion as a result of their high cultural importance, and their listing on the National Register of Historic Places. The Coso Hot Springs are surface manifestations of the Coso geothermal reservoir, although the connection between the hot springs and the reservoir is complex.

Little Lake

Little Lake is an approximately 90-acre perennial lake located at the south end of Rose Valley, to the south of the HGLA, approximately seven miles south of the town of Coso Junction (Figure 3.6-1). The majority of Little Lake is located within the Little Lake Ranch, which is a 1,200-acre privately-owned recreational preserve owned and managed by Little Lake Ranch, Inc. Ten acres at the southeast corner of Little Lake is owned by the BLM, and includes a visitor overlook. The Little Lake area includes two smaller perennial ponds, a “siphon well”, several other ponds that reportedly contain water intermittently, and adjacent wetland habitat. Little Lake is reportedly three to five feet deep (MHA 2008); the depths of the other ponds are unknown. The depth and area of the lake have been enhanced by the construction of a low dike along its southern perimeter; consequently, the water level in the lake is regulated by the rate of groundwater inflow into the lake and the setting of a discharge weir located at the south end of the lake.

Little Lake and the surrounding wetland areas and ponds are fed by Little Lake Canyon Creek and a combination of groundwater, submerged springs that discharge beneath the lake bottom, and a surface spring (Coso Spring). Situated at the south end of Rose Valley, groundwater flow through the Little Lake Gap is constrained by bedrock to the east and west, and by an apparent subsurface bedrock rise below. The ground surface in the area slopes gently to the south between the northern property line and Little Lake, then more steeply south of Little Lake. As a result of the combination of south-sloping ground surface and bedrock barriers to lateral or vertical groundwater flow, some portion of the groundwater flows through the Little Lake Gap and discharges to the surface in this area where it is detained in the lake and pond system before infiltrating back into the ground on the southern part of the property.

Water discharging from the Little Lake Outfall at the south end of Little Lake is conveyed to the upper Little Lake pond through an open channel. Groundwater discharging from the Coso Spring, located ¼ mile south of Little Lake, also flows into the upper Little Lake pond. A siphon well located south of Little Lake (below the elevation of Little Lake and Coso Spring) brings additional groundwater to the surface where it is piped to the lower Little Lake pond. The discharge from both ponds flows through an open channel to the south where it is used to fill additional ponds when flow is adequate. However, all of the groundwater that surfaces on the Little Lake Ranch property infiltrates back into the ground before leaving the property; therefore, no surface water discharges to Indian Wells Valley.

The siphon well consists of a short vertical well screen and a 12-inch-diameter discharge pipe. As long as the discharge pipe is full of water (is “primed”), the pipe suctions groundwater from the vertical well screen. Little Lake Ranch staff can raise or lower the weir to control the discharge rate when the lake level is high enough to sustain discharge. No provision acts to manipulate the discharge rate from Coso Spring or the siphon well; both flows in accord with prevailing groundwater conditions.

Because the Little Lake Ranch property receives little rainfall, the surface water features and riparian habitat on the property depend heavily on an uninterrupted supply of groundwater to maintain surface water flow rates and to sustain plant growth. As a requirement of the approval of the Hay Ranch groundwater diversion project, Inyo County is currently monitoring surface water discharge rates at three locations on the property (Little Lake Outlet, Coso Spring, and a surface water collection ditch called the North Culvert) as well as water levels in Little Lake, several wells on the property (Inyo Co. 2009), and additional wells throughout Rose Valley.

Surface Water Quality

The State Water Resources Control Board (SWRCB) and its nine Regional Boards were established by the Porter-Cologne Water Quality Act of 1969 (CA Water Code § 13140-13143) to implement the CWA in California under the delegation and oversight of the United States Environmental Protection Agency. The SWRCB and Regional Boards set water quality standards and control measures for surface and ground waters, and regulate storm water discharges from construction, industrial, and municipal activities; dredge and fill activities; the alteration of any federal water body under the Section 401 certification program; and several other activities with practices that could degrade water quality. The Regional Board for the HGLA is Region 6: Lahontan RWQCB.

The Water Quality Control Plan for the Lahontan Region sets standards for surface waters in the region of the HGLA (RWQCB 2005). These standards consist of designated beneficial uses for surface water, numeric and narrative objectives necessary to support beneficial uses,

and the state’s anti-degradation policy. Table 3.6-1 summarizes the beneficial water uses of surface waters in the affected action area.

Table 3.6-1 Beneficial Uses of Surface Waters in the HGLA

Surface Water	Beneficial Uses	Receiving Water
Minor Wetlands Along US 395	<ul style="list-style-type: none"> - Municipal & domestic supply - Agricultural supply - Groundwater recharge - Water recreation - Wildlife habitat - Preservation of biological habitats of special significance - Water quality enhancement - Flood peak attenuation/flood water storage 	N/A
Haiwee Reservoir Wetlands	<ul style="list-style-type: none"> - Municipal & domestic supply - Agricultural supply - Groundwater recharge - Water recreation - Cold freshwater habitat - Wildlife habitat - Water quality enhancement - Flood peak attenuation/flood water storage 	Haiwee Reservoir
Haiwee Reservoir	<ul style="list-style-type: none"> - Municipal & domestic supply - Agricultural supply - Industrial service supply - Groundwater recharge - Water recreation - Cold freshwater habitat - Wildlife habitat - Rare, threatened, or endangered species - Spawning, reproduction, & development of fish & wildlife 	LA Aqueduct
Little Lake	<ul style="list-style-type: none"> - Groundwater recharge - Water recreation - Warm freshwater habitat - Wildlife habitat 	Little Lake
Little Lake Canyon Creek	<ul style="list-style-type: none"> - Municipal & domestic supply - Agricultural supply - Groundwater recharge - Water recreation - Warm freshwater habitat - Wildlife habitat 	Little Lake
Intermittent Tributary	<ul style="list-style-type: none"> - Municipal & domestic supply - Agricultural supply - Groundwater recharge - Water recreation 	Little Lake

Surface Water	Beneficial Uses	Receiving Water
	<ul style="list-style-type: none"> - Warm freshwater habitat - Wildlife habitat - Water quality enhancement - Municipal & domestic supply - Agricultural supply - Groundwater recharge - Water recreation 	
Minor Wetlands	<ul style="list-style-type: none"> - Warm freshwater habitat - Wildlife habitat - Water quality enhancement - Freshwater replenishment - Flood peak attenuation/Flood Water Storage 	N/A

Source: Geologica 2010

Additional surface waters and their periodic beneficial uses include:

- Spring discharge from the Tunawee Canyon and Davis springs on the west side of Rose Valley is used for irrigation and domestic supply.
- Rose Spring is currently dry but apparently has been used in the past to water livestock.
- Use of discharge from Sacatar Canyon, Little Lake Canyon, and Little Lake Fault Springs was not identified but likely contributes to support of desert riparian plant stocks on the west side of US 395 near the Little Lake Ranch property.

Section 305(b) of the CWA mandates biennial assessments of the nation's water resources to identify and list waters with impaired water quality. The Lahontan RWQCB identified Haiwee Reservoir as being impaired due to elevated levels of copper. The Haiwee Reservoir is on the 2006 CWA 303(d) List of Water Quality Limited Segments (SWRCB 2009). Copper is related to LADWP's use of copper sulfate to control algae blooms that cause taste and odor problems in drinking water supplies. Section 303(d) requires the establishment of Total Maximum Daily Loads at a level necessary to implement applicable water quality standards. Total Maximum Daily Loads development for Haiwee Reservoir is in progress.

Wetlands

The National Wetlands Inventory identifies perennial and intermittent lakes, freshwater emergent, and freshwater forested/shrub wetlands on and in the vicinity of the HGLA (Table 3.6-2). The North Haiwee Reservoir and the South Haiwee Reservoir are two man-made permanently flooded lakes just north of the Rose Valley. They serve as storage for the Los Angeles Aqueduct system. At the south end, there is a shallow natural water feature called Little Lake. Flow south from Little Lake is controlled by a small earthen dam and a system of weirs with outflow into wetlands south of the lake. Freshwater emergent and scrub-shrub

wetlands are located along the shorelines of these three lakes and associated with the outflow. The most notable wetland within the HGLA is a playa lake in the southwest corner. Playa lakes are shallow, unvegetated, intermittent lakes exceeding 20 acres in size that contain water during the wet season and dry up in the summer. They are located on flat areas at the lowest part of an undrained desert basin. This playa lake receives drainage from Portuguese Canyon to the west. Smaller pond-sized playas are located elsewhere nearby. If ordinary high water mark indicators are present, these playas may be identified as potential non-wetland Waters of the United States and subject to United States Army Corps of Engineers (USACE) jurisdiction (USACE 2008).

Table 3.6-2 Wetlands on and in the Vicinity of the HGLA

Wetland Classification	Definition	Type and Area of Occurrence
L1UBHh	Lacustrine, limnetic, unconsolidated bottom, permanently flooded, diked/impounded	Lakes (Haiwee Reservoir and Little Lake)
PEMCh	Palustrine, emergent, seasonally flooded, diked/impounded	Freshwater emergent wetland (associated with Haiwee Reservoir and Little Lake)
PEMB	Palustrine, emergent, saturated	Freshwater emergent wetland (south of South Haiwee Reservoir)
L2USJ	Lacustrine, littoral, unconsolidated shore, intermittently flooded	Playa lake
PUSJ	Palustrine, unconsolidated shore, intermittently flooded	Playas
PSSCh	Palustrine, scrub-shrub, seasonally flooded, diked/impounded	Freshwater forested/shrub wetland (associated with Little Lake)
PEMFh	Palustrine, emergent, semi-permanently flooded, diked/impounded	Freshwater emergent wetland (associated with Little Lake)
PUSCh/PSSAh	Palustrine, unconsolidated shore, seasonally flooded, diked/impounded/palustrine, scrub-shrub, temporarily flooded, diked/impounded	Freshwater forested/shrub wetland and other (associated with Little Lake)

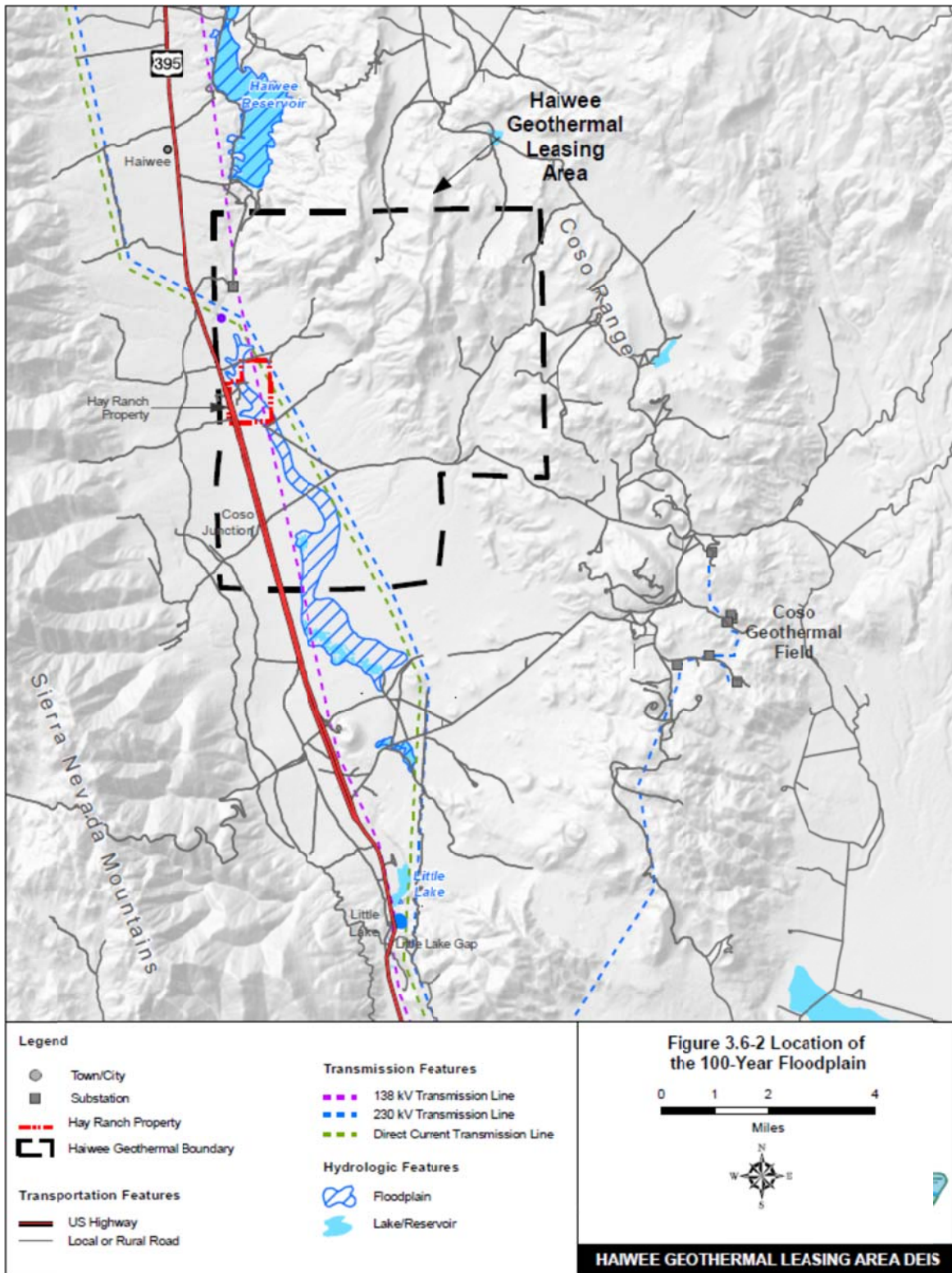
Source: Geologica 2010

Floodplains

Floodplain data for the HGLA was obtained from the Federal Emergency Management Agency (FEMA) National Flood Insurance Program maps. A 100-year floodplain (Zone A)

exists along the shores of the South Haiwee Reservoir, and in the low lying areas of Rose Valley where runoff from the surrounding mountains is captured (Figure 3.6-2). The valley floodplain crosses the southwest portion of the HGLA. It starts in the north end of the valley, three miles south of the South Haiwee Reservoir in T21S, R37E, Section 2, and extends south for seven miles to T22S, R38E, Sections 19 and 20, near the base of Red Hill. The floodplain contains the playa lakes described above. Zone A is considered a high flood risk area. Detailed analyses have not been performed for this zone; therefore, no depths or base flood elevations are shown.

Figure 3.6-2 Location of 100-year Floodplain



Groundwater

The principal hydrostratigraphic units that comprise the Rose Valley aquifer consist of recent alluvial deposits as well as the Coso Lake Bed and Coso Sand Members of the Coso Formation. No information was identified regarding the water-yielding properties of older bedrock underlying Rose Valley.

Groundwater Occurrence and Flow

Within Rose Valley, the groundwater table is typically first encountered during drilling within the upper portion of recent alluvial deposits. Figure 3.6-3 shows the lateral extent of alluvial deposits. Depth to groundwater ranges from 140 to 240 feet bgs in the north and central parts of Rose Valley. It raises to 40 feet bgs at the northern end of the Little Lake Ranch near the south end of the valley, and surfaces at the southern end of the Little Lake Ranch property.

Depth to groundwater and groundwater elevation in wells located throughout Rose Valley are being monitored for the Hay Ranch groundwater diversion project (Inyo Co. 2009). The estimated average groundwater elevation levels in Rose Valley, based on data obtained from monitoring wells in November 2009 from the groundwater elevation hydrographs published at the Inyo County Water Department's Hay Ranch Monitoring data portal (Inyo Co. 2009), are tabulated in Table 3.6-3. Figure 3.6-3 presents a groundwater elevation contour map of Rose Valley developed from these data. As depicted on Figure 3.6-3, the November 2009 groundwater elevation data indicated generally southeasterly groundwater flow along the axis of the northwest to southeast trending Rose Valley.

Long term groundwater level hydrographs posted at the Inyo County Water Department website (Inyo Co. 2009) indicate that groundwater levels have generally risen one to two feet in the central part of Rose Valley over the last six years. However, comparison of the estimated average November 2007 and November 2009 groundwater elevation values listed in Table 3.6-3 indicates that, with the exception of the LADWP Well 816 at the north end of Rose Valley, groundwater levels in most of the wells changed by less than one foot over the two-year period. Groundwater levels in the LADWP V816 well at the north end of Rose Valley vary up to five feet or more during the year. This area has lower transmissivity than the main part of Rose Valley (see discussion below), and is closer to the South Haiwee Reservoir; as a consequence, it may be influenced more by variable seepage losses from the reservoir.

Figure 3.6-3 Groundwater Elevation Contours (November 2009)

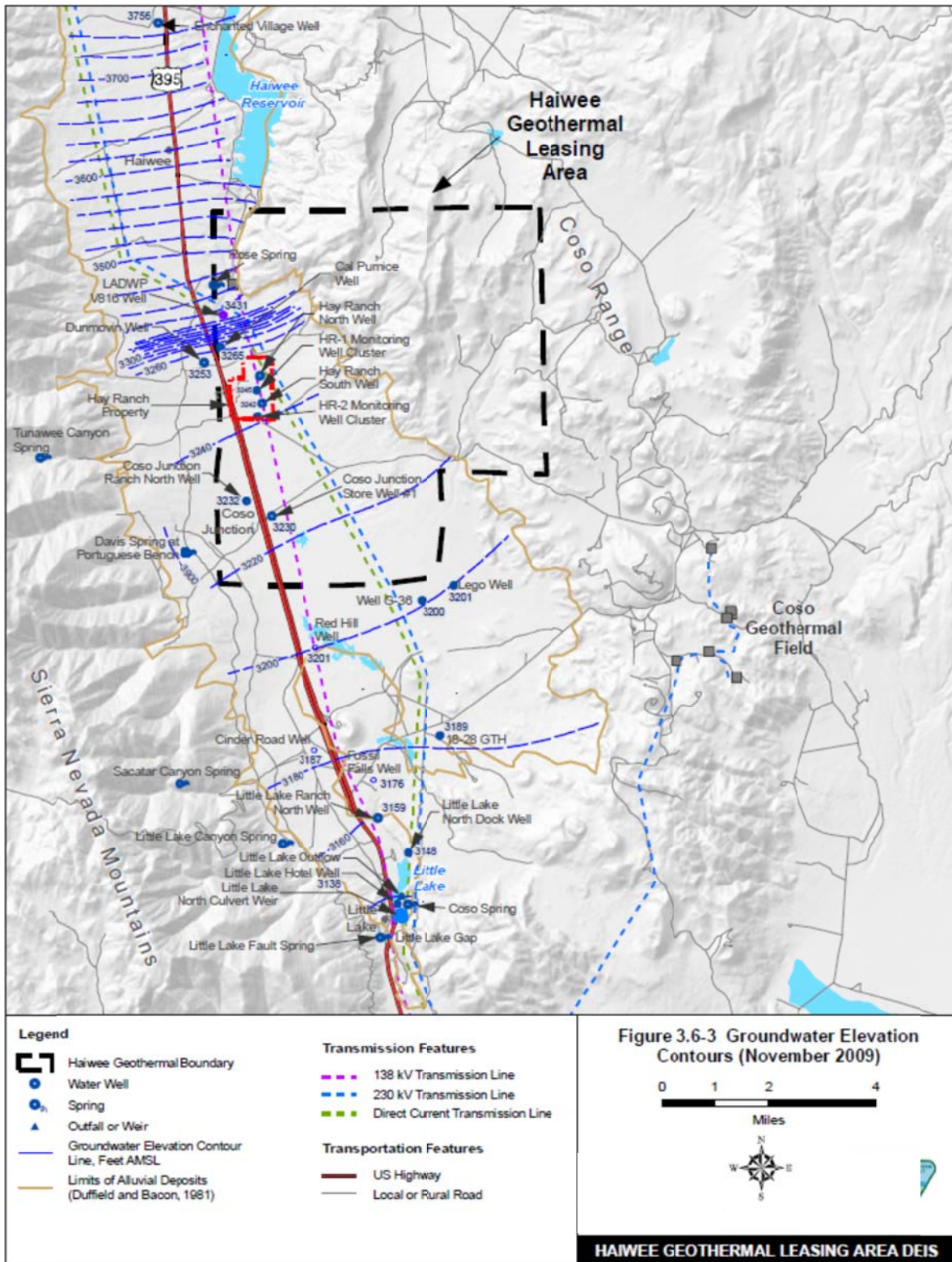


Table 3.6-3 Estimated Average November 2009 Groundwater Elevation

Well	Groundwater Elevation, feet amsl	
	November 2007 ⁽¹⁾	November 2009 ⁽²⁾
Enchanted Village	NM	3,755.5
LADWP 816	3,435.2	3,430.8
Dunmovin	NM	3,253.0
Cal Pumice	3,266.0	3,265.4
Hay Ranch North	3,245.0	3,245.3 ⁽³⁾
HR-1A	NM	3,244.3
HR-1B	NM	3,243.1
HR-1C	NM	3,245.6
HR-2A	NM	3,241.1
HR-2B	NM	3,238.5
HR-2C	NM	3,242.6
Hay Ranch South	3,240.9	3,241.8
Coso Junction Ranch	3,232.7	3,232.2
Coso Junction Store #1	3,229.3	3,229.8
Red Hill	NM	3,200.8
Lego	3,200.5	3,200.6
G-36	3,199.6	3,200.0
Cinder Road	NM	3,187.0
18-28 GTH	3,188.2	3,188.5
Fossil Falls	NM	3,175.6
Little Lake Ranch North	3,158.95	3,158.9
Little Lake Ranch Dock	NM	3,147.9
Little Lake Surface	NM	3,147.4
Little Lake Ranch Hotel	NM	3,138.3

Source: Geologica 2010.

Notes: (1) MHA (2008) Table 3.2-2

(2) Average November 2009 groundwater elevation estimated by Geologica from groundwater elevation hydrographs presented at the Inyo County Water Department's Hay Ranch Monitoring Website, <http://www.inyowater.org/coso/default.html> accessed December 4, 2009.

(3) Monitoring terminated in September 2009; groundwater level estimated from September 2009 monitoring results.

NM = not measured; amsl = above mean sea level

Aquifer Properties

Northern End of Rose Valley.

The LADWP conducted a 6.5 day pumping test in its wells in the northern end of Rose Valley in the spring of 2009. These LADWP wells are located approximately four miles north of Coso Junction. LADWP pumped Well V817 at a constant rate of 1.84 cubic feet per second (cfs) for 6.5 days. The pumping test resulted in 270 feet of drawdown in the pumping well, 48 feet of drawdown in a monitoring well (V816) located 197 feet west of the pumped well, and no drawdown in other nearby wells. LADWP concluded that this response indicated a small zone of influence and a deep cone of depression for pumping from this

well. LADWP estimated an average transmissivity of 1,340 feet squared per day (ft^2/day), and a storage coefficient of 0.004 based on groundwater level response during the pumping test.

North Central Rose Valley/Hay Ranch Area.

The transmissivity of the upper portion of the alluvial deposits was previously estimated to range from 9,000 to 69,800 gpd/ft (1,200 to 9,330 ft^2/day) based on data in the Rockwell Report (1980). Based on 24-hour pumping tests conducted in the Hay Ranch wells, GeoTrans (2003) concluded that the transmissivity of the Rose Valley aquifer near Hay Ranch was approximately 10,000 ft^2/day , and estimated that the (horizontal) hydraulic conductivity was 20 ft/day . GeoTrans concluded that they had insufficient data to estimate aquifer storage properties.

Based on a 14-day pumping test conducted in the Hay Ranch South well, and monitoring wells throughout the valley, it was concluded that the best estimates of the transmissivity and horizontal hydraulic conductivity of the aquifer were 14,750 ft^2/day and 24 ft/day , respectively (MHA 2008, Appendix C1). The vertical hydraulic conductivity of the alluvial aquifer in central Rose Valley was estimated to be 0.01 ft/day (using a Neuman “Beta” coefficient of 0.01 from the aquifer testing type curve match and an aquifer thickness of 600 feet). The storage coefficient applicable to early time response and saturated soil below the water table was found to be 0.001.

South End of Rose Valley.

No aquifer testing data have been identified for the southern portion of Rose Valley. Rockwell (1980) estimated the transmissivity of the aquifer near the Little Lake Hotel well to be on the order of 8,500 ft^2/day based on an empirical approximation related to well specific capacity. Based on calibration of a numerical groundwater flow model for the Rose Valley aquifer, GEOLOGICA (in MHA 2008, Appendix C2) estimated that the transmissivity of the southern portion of the Rose Valley aquifer ranged from 5,300 to 32,000 ft^2/day .

Summary.

As a result, a review of the groundwater elevation contour map developed for Rose Valley reveals the presence of several areas of distinctly different groundwater gradient, potentially indicating variable recharge rates or transmissivity in different parts of Rose Valley. From the vicinity of the Cal Pumice well near the north end of Rose Valley to Little Lake at the south end of Rose Valley, a relatively low groundwater gradient of approximately 20 ft/mile was observed (see Figure 3.6-2). At the north end of Rose Valley, between South Haiwee Reservoir and the LADWP V816 well, a higher gradient of approximately 135 ft/mile was observed. However, between the LADWP V816 and Cal Pumice wells, the groundwater elevation drops 120 feet in less than 0.2 miles, indicating a very high groundwater gradient. Groundwater inflow from alluvial fan deposits northwest of South Haiwee Reservoir, and

seepage losses from the reservoir, may contribute to the higher groundwater gradient near and immediately south of the reservoir. The pumping test conducted by LADWP in Well V817 indicated that the transmissivity of the aquifer in this area is likely significantly lower than it is in the main part of the valley. The very high groundwater gradient between Well V816 and Cal Pumice well is likely indicative of a very low permeability zone. USGS (2009) has concluded that a barrier to groundwater flow exists in this area. However, the consistent southerly groundwater gradient from the Enchanted Village well at the north end of the HGLA to LADWP's Well V816, Cal Pumice well, and remaining wells in southern Rose Valley indicates that continuity of groundwater flow exists.

Groundwater Quality

The chemistry of groundwater found in Rose Valley and the associated watershed varies widely, reflecting the multiple types of waters within a hydrological system typical of the semi-arid western United States. Water chemistry is influenced by the interaction between groundwater and rock along the hydrological flow paths and by the addition of a geothermal brine component. Recharge waters from drainage from the mountains surrounding Rose Valley have lower dissolved solids than the valley's groundwater, which typically is higher in dissolved solids reflecting longer transit times and a greater degree of water-rock interaction.

Total dissolved solids (TDS) range from very low to a few hundred milligrams per liter (mg/L) in surface streams draining the Sierras to the west of the HGLA or in springs of the Coso-Argus Range to the east, to several thousand mg/L in geothermal brines in the Coso Geothermal Reservoir and related geothermal surface manifestations to the east of the HGLA. Groundwater in the northern Rose Valley near Hay Ranch is characterized by TDS between 800 and 900 mg/L, whereas groundwater in the southern Rose Valley is characterized by TDS from 500 to 700 mg/L. At Little Lake, the water is slightly brackish with TDS from 1,500-2,500 mg/L. A more detailed discussion of the valley's ground water chemistry is presented in Appendix C.

Hay Ranch groundwater appears to be a more concentrated version of Haiwee Reservoir water. The dominance of sulfate in waters in the northern part of Rose Valley (Hay Ranch and Dunmovin) distinguishes these waters from the rest of the valley. Although the Hay Ranch wells were drilled deeper than many of the other wells in the valley, the Dunmovin well is not, so depth alone probably does not produce the difference in water chemistry. Similarly, concentration of these waters by evaporation alone would not produce the chemistry of the Little Lake waters, suggesting that other waters must mix with the northern Rose Valley waters as they flow southward towards Little Lake prior to evaporation in the Lake which produces the distinct chemistry of Little Lake water.

Because the shallow Little Lake waters are enriched in two stable isotopes (oxygen-18 and deuterium) and chloride, evaporation does likely contribute to lake chemistry. Both chloride and stable water isotopes become enriched when water is evaporated, but only chloride and one of the stable isotopes, oxygen-18, are enriched in geothermal waters. Coso Geothermal Field waters are also enriched in chloride relative to Rose Valley waters, by a factor of 10, but not in deuterium or as significantly in oxygen-18. This suggests that mixing of geothermal waters from the Coso geothermal field is unlikely to impact the Little Lake water significantly. However, comparison of chloride, deuterium, and oxygen-18 in Little Lake and Coso geothermal waters, does suggest that the Lego well, located on the southeast side of Rose Valley, may be a mixture of Sierra water and Coso geothermal water.

Current Groundwater Use

Groundwater in Rose Valley is used for domestic drinking water supply, limited irrigation, light industrial processes, and, at the south end of the valley, for maintenance of riparian habitat in the Little Lake area. Starting in late 2009, groundwater from the two Hay Ranch wells has also served as makeup water for the Coso Geothermal facilities. The Hay Ranch Groundwater Extraction and Delivery System project started pumping in late December 2009. Under the terms of Inyo County's Conditional Use Permit, the project proponent, Coso Operating Company, is allowed to extract groundwater from two wells on the Hay Ranch property near the north end of the valley, and conveys the water by surface pipeline across the HGLA to the Coso Geothermal field nine miles to the southeast. The amount of pumping that is initially permitted, 3,000 acre-feet per year, is a large fraction of the estimated 5,100 acre-feet per year annual recharge to the Rose Valley aquifer. As a result, this withdrawal represents the single largest use of groundwater in Rose Valley. Previously, the Draft EIR for the Hay Ranch Water Extraction and Delivery System Project (MHA 2008) estimated that 40 acre-ft/yr of groundwater production from wells are available in Rose Valley. Rockwell (1980) reported that irrigation pumping at the Rose Valley Ranch (now referred to as the Hay Ranch) started in 1975, and averaged 3,000 acre-ft/yr. In 1979, the Rose Valley Ranch reportedly pumped 3,130 acre-ft/yr of groundwater from the two wells on the property for alfalfa irrigation. Alfalfa farming ceased in the early 1980s. No significant agricultural irrigation, or groundwater extraction for any other purpose, had occurred in the valley since that time until development and startup of the Hay Ranch Water Groundwater Extraction and Delivery Project.

Drinking water quality (potability) of waters within the Rose Valley ranges from excellent to marginal. Available data (MHA-RMT 2009) indicate that Hay Ranch waters exceed primary drinking water standards (USEPA 2003) for arsenic, nitrate and nitrite. Secondary drinking water standards are primarily related to aesthetics and taste. Several waters exceed the secondary drinking water standard levels for TDS and sulfate. Recent analysis of water samples from the Hay Ranch wells indicates the water does not meet secondary drinking water standards for TDS, sulfate, iron and manganese (Table 3.6-4).

Table 3.6-4 Hay Ranch Wells - Drinking Water Quality Test Results

Hay Ranch North and South Well Groundwater Analytical Results for Drinking Water Quality								
Analyte	Drinking Water Standard¹	MCL² or Secondary Level² (mg/l)	South Well 09/10/03 Result³ (mg/l)	South Well 09/11/03 Result³ (mg/l)	South Well 12/03/07 Result⁴ (mg/l)	North Well 09/13/03 Result³ (mg/l)	North Well 09/14/03 Result³ (mg/l)	Coso Junction Office Well⁴ 01/30/03 Result³ (mg/l)
General Minerals								
Alkalinity, Total			330	320		260	250	
Bicarbonate (as CaCO ₃)			330	320		260	250	326
Carbonate (as CaCO ₃)			ND	ND		ND	ND	
Hydroxide (as CaCO ₃)			ND	ND		ND	ND	
Chloride	Secondary	250	74.1	75.7	73	72	79	33.7
Conductivity (umho/cm)			1320	1300		1360	1370	
Cyanide	Primary (CA)	0.15			<0.1			
Fluoride	Primary	2.0	0.22	0.20	0.31	0.15	0.20	0.53
Hardness (Ca, Mg-CaCO ₃)			465	455		430	430	
Nitrate	Primary	10	2.15	2.60	12	1.44	2.05	6.01
Nitrite	Primary	1			2.7			
Sulfate	Secondary	250	257	251	260	336	329	97.3
Total Dissolved Solids (TDS)	Secondary	500	850	844	850	910	945	634
Other								
pH (pH units)	Secondary	6.5-8.5	7.12	7.28	7.61	7.43	7.48	6.53
Color	Secondary	15 units			<3.0			
Odor	Secondary	3 ton			<1.0			
MBAS	Secondary	0.5			<0.05			
Asbestos	Primary	7 MFL			<0.02 MFL			
Metals								
Aluminum	Primary (CA)	1			0.054			
Antimony	Primary	0.006	ND	ND	<0.002	ND	ND	
Arsenic	Primary	0.010	ND	ND	0.016	ND	ND	0.0034

Hay Ranch North and South Well Groundwater Analytical Results for Drinking Water Quality

Analyte	Drinking Water Standard ¹	MCL ² or Secondary Level ² (mg/l)	South Well 09/10/03 Result ³ (mg/l)	South Well 09/11/03 Result ³ (mg/l)	South Well 12/03/07 Result ⁴ (mg/l)	North Well 09/13/03 Result ³ (mg/l)	North Well 09/14/03 Result ³ (mg/l)	Coso Junction Office Well ⁴ 01/30/03 Result ³ (mg/l)
Barium	Primary	2	0.058	0.042	<0.1			
Beryllium	Primary	0.004	ND	ND	<0.001	ND	ND	
Cadmium	Primary	0.005	ND	ND	<0.001	ND	ND	
Calcium			114	113		97.6	96.3	73.7
Chromium	Primary	0.1	ND	ND	<0.01	ND	ND	
Cobalt			ND	ND		ND	ND	
Copper	Primary	1.3	ND	ND	<0.05	ND	ND	
Fluoride	Primary	0.002						
Iron	Secondary	0.3	7.01	0.27	<0.01	1.35	0.114	
Lead	Primary	0.005	ND	ND	<0.002	ND	ND	
Magnesium			39.8	37.7				
Manganese	Secondary	0.05	0.449	0.047	<0.02	37.6	36.0	36.6
Mercury	Primary	0.002	ND	ND	<0.0002	ND	ND	
Molybdenum			ND	ND		ND	ND	
Nickel			ND	ND		ND	ND	
Potassium			11.8	11.8		8.67	9.38	6.91
Selenium	Primary	0.05	ND	ND	0.003	ND	ND	
Silver	Secondary	0.10	ND	ND	<0.01	ND	ND	
Sodium			111	111		136	133	50.3
Thallium	Primary	0.0005	ND	ND	<0.001	ND	ND	
Vanadium			ND	ND		ND	ND	
Zinc	Secondary	5	0.032	0.022	<0.05	0.033	0.036	

Source: Coso Operating Company 2008.

Notes: This table is compiled from Geotrans, 2004 with addition from Coso in 2007.

¹ Primary and secondary drinking water standards as defined by the US EPA, June 2003, unless noted with 'CA' for California Standards.

² MCL = Maximum Contaminant Levels are legally enforceable standards that apply to public water systems; Secondary Levels are suggested but not enforceable guidelines for drinking water.

³ Results are bold for those that exceed the MCL of Secondary Level for the respective analyte.

⁴ Coso Junction office well results received from Paul Spielman, Caithness Energy.

At the north end of Rose Valley, as many as 30 domestic wells are believed to extract relatively small quantities of groundwater for domestic uses and small scale irrigation in the Dunmovin area. The Coso Ranch South well, southern Coso Junction Store well (Coso Junction #2), and the Cal Trans well at Coso Junction are regularly used by businesses in the area. The Cal-Pumice mine reportedly takes five to 10 tanker trucks of water a day during the workweek from the Coso Ranch South well. The Coso Junction Store well supplies the general store and Coso Operating Company offices in Coso Junction. One of the wells near the north end of the Little Lake Ranch property reportedly provides water to a local cinder mine. The Siphon Well on the Little Lake Ranch property extracts groundwater in a gravity-

fed system and delivers it to a pond a short distance to the south; some portion of that water likely evaporates, but the majority is believed to infiltrate back into the aquifer.

Anticipated Future Groundwater Use

A pending groundwater extraction project is proposed by the LADWP to capture groundwater seepage from the South Haiwee Reservoir using wells owned by LADWP located at the north end of Rose Valley. If approved, this project would reportedly entail extracting groundwater at a rate of 870ac-ft/yr for discharge into the adjacent LADWP aqueduct. LADWP is still in the planning stages for this project.

3.6.2.2 Geothermal System and Surface Manifestations

The relationship between the HGLA and the Coso Hydrothermal System is described below. The HGLA lies north and west of the Coso Hydrothermal System which is currently supplying geothermal fluids for power generation (see Figure 3.6-4). No geothermal exploration results for this area appear to be readily available in the public domain (BLM, 2009, personal communication). Therefore, the relationship between the areas must be evaluated using comparison of the general geologic setting.

The geologic setting which has produced the Coso geothermal system includes:

- **Permeability:** A zone of crustal extension in a releasing step over between two major faults that has generated brittle faulting within the field and produced the fracture permeability within the geothermal system. This faulting theoretically terminates at depth in the transition from brittle to ductile rock at four kilometers and to the west at Sugar Loaf Mountain (Unruh et al. 2001).
- **Heat:** A heat source at 2.5 miles, consisting of a partially liquid crystallizing rhyolite magma body, underlies the Coso geothermal system and probably produced the most recent igneous manifestation: the 40,000 year old rhyolite dome known as Sugarloaf Mountain. (Wicks, et al. 2001);
- **Fluid:** Evidence of meteoric water influx (Adams, et al. 2000).

Permeability

Surface rocks in the HGLA appear to be primarily valley sediments, but volcanics of the Coso Range and Mesozoic Sierra granitic rocks outcrop in the uplifted eastern side of the area (see Figure 3.6-1).

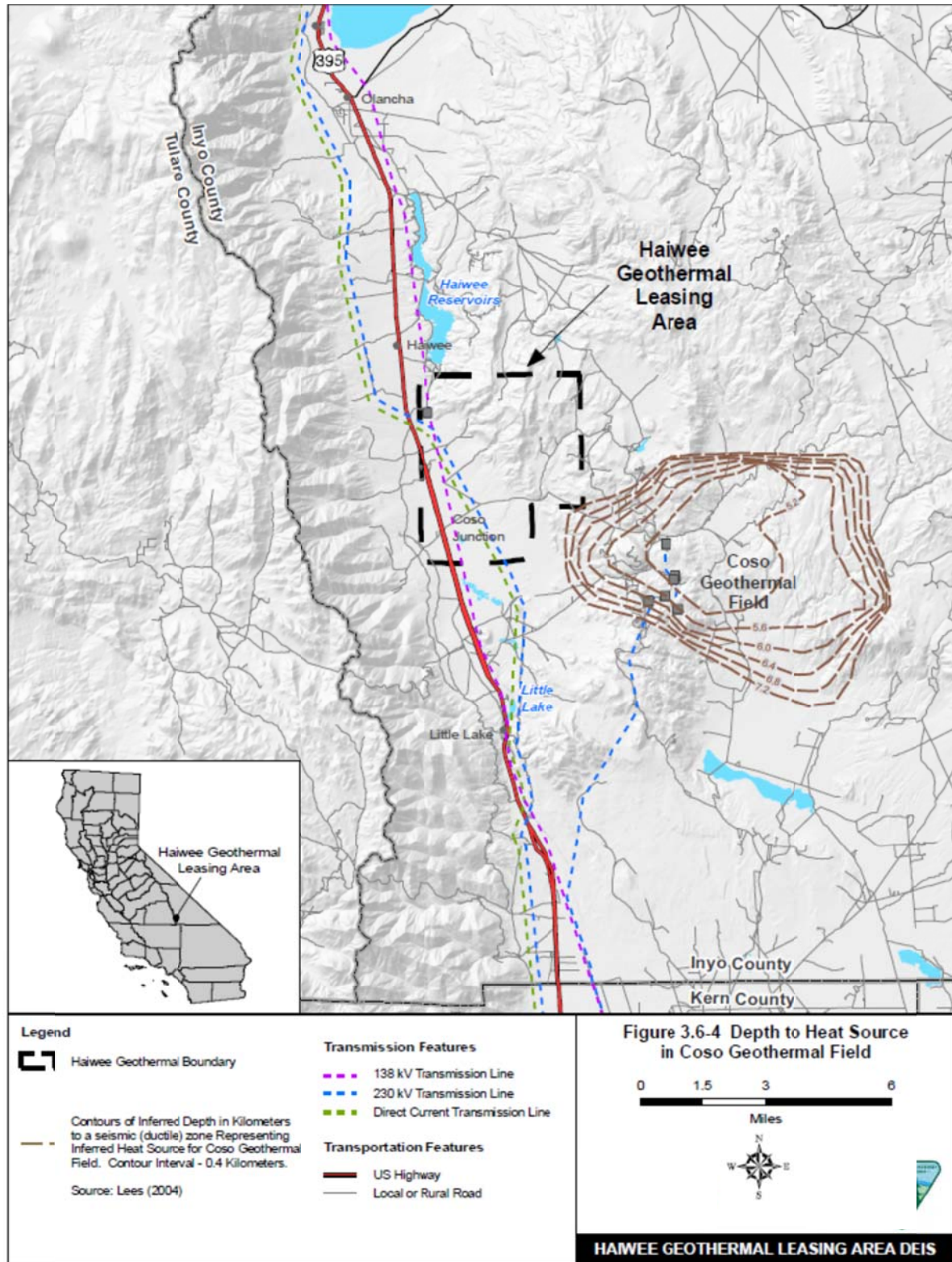
Mesozoic granitic rocks similar to those which form the reservoir rock for the Coso geothermal system appear to underlie the HGLA. The basement rocks of Rose Valley are thought to be Sierran granitic rocks. Although these rocks outcrop on the eastern side of the

HGLA, the basement rocks beneath the valley sediments may be between 4,000 and 9,000 feet below the surface (MHA-RMT 2009) at the northern end of the HGLA.

The HGLA lies within the highly active seismic region in the transition zone between the extensional Basin and Range and Eastern California strike slip faulting zone which hosts the Coso geothermal system. One of the most significant faults in the area is the Little Lake fault (Bhattacharyya and Lees 2002), a northwest trending primarily right-slip fault related to the Sierra Nevada fault system. Seismic activity to the north in the Coso Range is primarily small magnitude ($M < 5$) earthquakes expressing north striking right lateral oblique-slip extension. Seismicity in the Coso field is distinct from the fault-related earthquakes in the valley area and the rest of the Coso Range in that the seismicity is characterized by high decay rates, more numerous seismic events, and transtensional stress.

Although the HGLA is distinguishable from the Coso geothermal area, the high level of seismicity in the HGLA and the presence of the same rocks that have fractured to host the geothermal system suggest that the fracture permeability enabling hydrothermal circulation of the Coso system could also be present in the HGLA.

Figure 3.6-4 Depth to the Heat Source in Coso Geothermal Field



Heat Source

The geophysical anomalies that indicate the presence of a magmatic heat source for the Coso area are thought to be a crystallizing rhyolitic magma at the brittle-ductile transformation. This magma was probably the source of the Pleistocene domes that characterize the Coso Geothermal System, including the 40,000 year old Sugar Loaf Mountain eruption. Several features indicate that this heat source does not extend north and west of the currently exploited Coso geothermal field:

1. The predominant volcanic rock outcropping in the HGLA is older (at 4.5 - 6 million years (Duffiend and Bacon 1980)) than the volcanic rock (at more than one million years) overlying the Coso Geothermal System.
2. The recent resurgence of heat within the Coso geothermal system has been east and south of the current geothermal field (Adams, et al. 2000).
3. At least some of the geophysical anomalies that have been related to the presence of rhyolitic magma at 2.5- 3.7 miles in depth do not extend significantly north of the field. Figure 3.6-4 shows the area based on 3D interpretation of seismic data, relative to the HGLA.

Water Source

The source water for almost all geothermal systems that will feasibly support commercially viable power generation is meteoric water. The original source of the water in the currently exploited Coso geothermal system is meteoric water from the Sierra Nevada or a combination of waters from the Coso Range and the Sierra Nevada. The regional flow of water is northwest to southeast (Williams 2004).

The source water of shallow groundwater in the valley portion of the HGLA, based on water samples from wells, appears to be Sierran waters. The Coso geothermal system may leak to the south and the west (Williams 2004, MHA-RMT 2009), but there is no evidence of leakage to the northwest. The Sierra Nevada appears to be recharging the Rose Valley aquifer along the length of the Rose Valley (MHA-RMT 2009). However, surface springs do not appear to be related to deeply circulating waters within the HGLA. Springs within the Coso Range occur significantly east of the HGLA and do not appear to be recharged by Sierran water but carry the distinct characteristics of non-thermal Coso Range water.

Although the structural location of the HGLA differs from the Coso geothermal system, the active tectonic setting indicates a potential for fractured permeability. The presence of a heat source or the extension of the Coso geothermal system heat source close to or underlying the HGLA has not been proven by the extensive geophysical analysis of the Coso system. Recharge of deep aquifers within the HGLA by Sierran water is consistent with the

conceptual model of interbasin flow postulated by several hydrologic models of Rose Valley (Williams 2004, MHA-RMT 2009); however, there is no direct evidence of this.

In summary, the HGLA has similarities and differences with the currently producing Coso Geothermal System. Both areas are underlain by Sierran granitic rocks and are in seismically active areas of high stress. The presence of a shallow magmatic heat source has been identified under the Coso system but is not defined under the HGLA. Sierran water probably recharges aquifers in the HGLA, but the actual depth is unknown.

3.7 BIOLOGICAL RESOURCES

3.7.1 Applicable Regulations, Plans, Policies/Management Goals

A number of federal laws and state regulations provide protection to specific animal and plant species and habitats. In addition, the CDCA and West Mojave (WEMO) Plans provide a number of policies and management goals for specific biological resources occurring in and around the HGLA.

At the federal level, the U.S. Fish and Wildlife Service (USFWS) protects all federally listed threatened, endangered, or proposed, species under the Endangered Species Act (ESA) (e.g., 50CFR 17.11 and 17.12). The USFWS also offers comprehensive protection for migratory bird species under the Migratory Bird Treaty Act (MBTA) (16 USC § 703-711; 50 CFR 10), and additional protection for bald and golden eagles under the Bald and Golden Eagle Protection Act (16 USC 668– 668d, 54 Stat. 250, as amended). It should be noted that the 1978 amendment to the Act authorizes the Secretary of the Interior to permit the taking of golden eagle nests that interfere with resource development or recovery operations. The BLM also has specific management guidelines for raptors, including golden eagles. In addition, the BLM affords protection to select species listed on BLM’s “Sensitive Species” list which includes all USFWS-listed and proposed species, and/or species listed under the California Endangered Species Act. It is BLM’s policy to provide those species listed on BLM Sensitive Species list the same level of protection that is given USFWS-listed species.

At the state level, the California Department of Fish and Game protects specific species under California’s Endangered Species Act (14 California Code of Regulations 670.5). Additional protection is provided to species listed under California’s Environmental Quality Act (CEQA) (CEQA Guidelines Section 15380) and under California’s Native Plant Protection Act (California Fish and Game Code 1900 et seq.).

These federal and state endangered species program objectives are reflected in the corresponding management goals of the CDCA Plan which identify specific objectives to

protect Mojave Desert vegetation communities and wildlife species. The following CDCA Plan goals and objectives pertain to the biological resources of the HGLA:

Vegetation Management Goals

1. Maintain the productivity of the vegetative resource while meeting the consumptive needs of wildlife, livestock, wild horses and burros, and man. Provide for such uses under the principles of sustained yield.
2. Manage those plant species on the federal and state lists of threatened and endangered species and their habitats so that the continued existence of each is not jeopardized. Stabilize and, where possible, improve populations through management using recovery plans developed and implemented cooperatively with the USFWS and the CDFG.
3. Manage those plant species officially designated as sensitive by the BLM for California and their habitats so that the potential for federal or state listing is minimized. Include consideration of sensitive species habitats in all decisions such that impacts are avoided, mitigated, or compensated.
4. Manage rare plant assemblages so that their continued existence is maintained. In all actions, include consideration of rare plant assemblages so that impacts are avoided, mitigated or compensated.
5. Accomplish other resources management objectives by altering plant composition, density, and/or cover including eliminating harmful or noxious plants, increasing livestock or wildlife forage production, and improving wildlife habitat characteristics by maintaining diversified, native plant communities which are favored over monocultures or communities based on non-native species.

Wildlife Management Goals

1. Avoid, mitigate, or compensate for impacts of conflicting uses on wildlife populations and habitats. Promote wildlife populations through habitat enhancement projects so that balanced ecosystems are maintained and wildlife abundance and diversity provides for human enjoyment.
2. Develop and implement detailed plans to provide special management for: a) areas which contain rare or unique habitat; b) areas with habitat which is sensitive to conflicting uses; c) areas with habitat which is especially rich in wildlife abundance or diversity; and d) areas which are good representatives of common habitat types.

Many areas falling into these categories contain listed species, which may become the focus of management.

3. Manage those wildlife species on the federal and state lists of threatened and endangered species and their habitats so that the continued existence of each is not jeopardized. Stabilize and, where possible, improve populations through management using recovery plans developed and implemented cooperatively with the U.S. Fish and Wildlife Service (USFWS) and the California Department of Fish and Game (CDFG).
4. Manage those wildlife species officially designated as sensitive by the BLM for California and their habitats so that the potential for federal or state listing is minimized.
5. Include consideration of essential habitats of sensitive species in all decisions so that impacts are avoided, mitigated, or compensated.

The HGLA lies within the designated Mojave Ground Squirrel Conservation Area (MGSCA), as identified in the WEMO Plan. Currently the WEMO Plan serves as the Habitat Management Plan for Mojave ground squirrel (*Xerospermophilus Mojavensis*) conservation on BLM-managed lands, as per the CDCA Plan (BLM 2000). The Plan stipulates that permanent new ground disturbance within the MGSCA be limited to one percent (1%) of existing habitat, or a total of 10,387 acres (BLM 2000), over the life of the 30-year plan.

The BLM manages the MGSCA under the same provisions that apply in the Desert Wildlife Management Areas (DWMAs) as identified in the 1992 CDCA Memorandum of Understanding. The following measures identified for DWMAs include “Tortoise Survey Areas” and “No Survey Areas” that apply to the HGLA:

- Within DWMAs, presence-absence surveys and clearance surveys will be required. Tortoises should be moved only by certified/authorized biologists from the immediate area of impact to adjacent suitable habitat (or burrow). In general, tortoises should be moved no further than 1,000 feet from the impact area. The potential for these animals to wander back into harm’s way should be taken into account, and the 1,000-foot distance modified by the authorized biologist, as necessary.
- Temporary or permanent fences may be needed to prevent tortoise immigration into the impact area.

The WEMO Plan also addresses birds, and includes specific conservation strategies for the following raptor species: burrowing owl (*Athene cunicularia*), ferruginous hawk (*Buteo regalis*), golden eagle (*Aquila chrysaetos*), long-eared owl (*Asio otus*), and prairie falcon (*Falco mexicanus*). Conservation strategies identified for raptors are incorporated into the Best Management Practices (Appendix A).

3.7.2 Affected Environment

The HGLA is located on the eastern slope of the Sierra Nevada Mountains, in the Coso Range, and in the Rose Valley. It is generally within the western portion of the Mojave Desert area. The western Mojave Desert is generally flat and sparsely vegetated, with creosote bush and saltbush plant communities dominating the landscape (BLM, 2003). Elevations in the Mojave Desert generally vary from approximately 1,355 to 4,440 feet above mean sea level (amsl). Within the HGLA elevations are between about 3,200 feet amsl in the Rose Valley to about 5,700 feet amsl in the Coso Range. Summer temperatures are often greater than 110°F, and winter snow or frost can occur with temperatures below 32°F. Annual precipitation is less than 7 inches (including snowfall) and can be variable from year to year.

3.7.2.1 Vegetation

The Haiwee Geothermal Leasing Area is located at the southwestern edge of the Great Basin Floristic Province and is adjacent to the California Floristic Province and the Desert Floristic Province as described in the *Jepson Manual, Higher Plants of California*. This has resulted in components from all three of these provinces occurring in the area. Most of the study area supports what Sawyer, Keeler-Wolf and Evens, in *A Manual of California Vegetation second edition*, describe as vegetation alliances dominated by shrubs. The description of plant communities follows the classification system provided in *A Manual of California Vegetation*. Scientific names and common names are according to *The Jepson Manual*.

Alliances with creosote bush (*Larrea tridentata*) occupy the majority of the leasing area. Creosote bush occurs both as a dominant in a *Larrea tridentata* Shrubland Alliance and as a codominant in a *Larrea tridentata*-*Ambrosia dumosa* Shrubland Alliance. Common perennial species found in these alliances include Creosote bush, Burro-bush or Bursage (*Ambrosia dumosa*), Winterfat (*Krascheninnikovia lanata*), Spiny Hop-Sage (*Grayia spinosa*), Desert needlegrass (*Achnatherum (Stipe) speciosa*), Indian ricegrass (*Achnatherum (Oryzopsis) hymenoides*) and Varied bluegrass (*Poa secunda*). Emergent Joshua trees (*Yucca brevifolia*) also occur in lower numbers within these alliances. This series occurs on alluvial fans, bajadas, and upland slopes having well-drained soils.

Where higher numbers of Joshua trees occur, the vegetation may be classified as a *Yucca brevifolia* Woodland Alliance. In this alliance the Joshua trees may form small stands or be solitary. Cover of Joshua trees would be typically $\geq 1\%$. This alliance typically occurs at the upper edge of the creosote alliances so it may include most of the species associated with those alliances. It may also include species from adjacent higher elevation associations including big sage (*Artemesia tridentata*), Black brush (*Coleogyne ramotissia*), Nevada Ephedra (*Ephedra nevadensis*) and green rabbitbrush (*Chrythomnsus viscidiflorus*)

The bottom of the Rose Valley supports an *Atriplex polycarpa* Shrubland Alliance. This alliance is often considered part of chenopod or saltbush scrub where allscale (*Atriplex polycarpa*) is the dominant shrub in the canopy. Shrubs in this alliance are often less than 3 m tall, with canopies that are either continuous or open. In the HGLA, allscale series usually occurs in sandy soils along the edges of dry lakes, on dissected alluvial fans, and on rolling hills. Common species in this series include allscale (*Atriplex polycarpa*), shadscale (*Atriplex confertifolia*), and bud sage (*Artemesia spinescens*). The *Atriplex polycarpa* Shrubland Alliance occurs in larger scattered patches in the central portions of the Haiwee Geothermal Leasing Area.

The shrub alliances typically support an herbaceous layer that may include less than a dozen species of perennial grasses and forbs. In addition the herbaceous layer can include an extremely diverse number of annual forbs and grasses.

Invasive, Non-Native Species

Peter Rowlands et al. (1982) in Brooks (1998) notes that alien species comprise a relatively small portion of the flora in the deserts. They indicate that there approximately 1836 species of vascular plants in the California portion of the Mojave Desert of which 156 (9%) are alien to the region. This compares to the global average of 16% alien plants (Rowlands et al. 1982). Fraga (2005) studied the area immediately south of the Haiwee Geothermal Lease area and found that non-native species comprised 4% of the flora in that area. The non-native species can be classified into three general groups.

The first group is invasive, non-native plants which are common across the landscape. Species in this group are common across the Mojave Desert and many are common in surrounding bioregions as well. These species occur in most portions of allotment and combined, they generally constitute less than 20 % of the total cover. Species in this group include downy brome or cheat grass (*Bromus tectorum*), red brome grass (*Bromus (rubens) madritensis Ssp. rubens*), Mediterranean grass (*Schismus arabicus and barbatus*), filaree (*Erodium cicutarium*) and tansy mustard (*Descurania sophia*). None of the species in this group are classified as noxious weeds.

The second group of invasive, non-native species is also common in the desert, but is more restricted in the habitats they occupy. For the most part this group is limited to road sides, some washes and other highly modified sites where there is little competition from other plants and water concentrates to provide late season soil moisture. Adequate soil moisture in the late spring and early summer is important for these species. Most of these species are warm season plants. These species occur along paved road corridors through and adjacent to the lease area. Road maintenance practices and equipment play a strong role in maintaining the site disturbance and in spreading seeds of these species. Major species in this group include Moroccan mustard (*Brassica tourenfortii*), Mediterranean mustard (*Hirschfeldia incana*), black mustard (*Brassica nigra*). None of these species are listed noxious weeds. Russian Thistle (*Salsola atragus*) is also found in this group and is a “C” rated noxious weed.

The third group of invasive non-native species is species which occur as a series of specific infestations at specific sites. All of these species are listed noxious weeds and have active control efforts in place. A number of these species occur in the region, but none are known to occur within the HGLA.

The introduction of invasive, non-native species, especially noxious weeds is very difficult if not impossible to reverse if not detected early. For that reason, the integrated weed management plan includes detection and prevention plans (USDI BLM 2006b).

3.7.2.2 Fish and Wildlife

As described above, the HGLA supports a number of vegetation communities that provide habitat for a variety of wildlife species.

Mammals

Common mammals known to occur in the HGLA include coyotes, black-tailed jackrabbits, kangaroo rats and pocket mice. Townsend’s big-eared bat, a species listed as sensitive by the BLM, has been documented in the area. A number of mammals common to the area have adapted to the high diurnal temperatures by spending much of the day underground, or in aestivation (summer sleep). As a result, the HGLA supports a high proportion of burrowing rodents. Other mammals that may occur include bobcats, antelope ground squirrels and deer mice. Research by P. Leitner southeast of the HGLA documents the presence of the Mojave ground squirrel (Leitner and Leitner 1989, 1990; Leitner et al. 1997), which is listed as an endangered species by the State of California Department of Fish and Game and is a BLM Sensitive Species.

Birds

The generally sparsely vegetated habitats of the HGLA do not support a high diversity of birds. In the vicinity of the HGLA, the largest number of breeding bird species is expected to be found outside its boundaries near South Haiwee Reservoir and Little Lake (BLM 1980).

In general, bird diversity in the HGLA increases during the spring and fall when migrant birds pass through the area enroute to summer breeding or wintering grounds. Many bird species in the greater Haiwee area are seasonal residents, and exhibit seasonal migrations. The USFWS has outlined a plan to conserve and protect migratory birds in its Migratory Bird Strategic Plan 2004-2014. The strategy includes direct collaboration with the BLM in making land use and planning decisions within the Pacific Flyway. Conservation strategies have been identified for migrating birds, and have been incorporated into Appendix A, Best Management Practices.

The distribution of bird species inhabiting the HGLA depends on habitat type. Common passerine species expected throughout much of the HGLA include sage sparrow (*Amphispiza belli*), black-throated sparrow (*Amphispiza bilineata*), California horned lark (*Eremophila alpestris actia*), and verdin (*Auriparus flaviceps*). The number of raptor and owl species differs considerably by season. However, common raptor species in the HGLA include red-tailed hawk (*Buteo jamaicensis*), great-horned owl (*Bubo virginianus*), and American kestrel (*Falco sparverius*). The HGLA avifauna also includes the burrowing owl, a year round resident and BLM Sensitive Species.

Reptiles

Rocky outcrops, bajadas, washes, and gravel plains support a varied herpetofauna, with certain species occurring commonly across most habitats. The HGLA provides these habitats, and supports such species which generally prefer habitats which are warm and arid with sparse vegetation. Common reptiles expected to occur include side-blotched lizard (*Uta stansburiana*), western whiptail (*Aspidoscelistigris*), gopher snake (*Pituophis catenifer catenifer*), red coachwhip (*Masticophis flagellum piceus*), long-nosed leopard lizard (*Gambelia wislizenii*), and zebra-tailed lizard (*Callisaurus draconoides*). Rattlesnakes such as the Panamint rattlesnake (*Crotalus stephensi*) and the Mojave Desert sidewinder (*Crotalus cerastes cerastes*) may also be present. Several of these species have been reported within the California Natural Diversity Data Base at several sites near the HGLA, and may be common throughout the rest of the HGLA (Eremico 2009).

The HGLA is near the northern extent of the range of the desert tortoise (*Gopherus agassizii*). Typical tortoise habitats include creosote, burrobrush, saltbush scrub, yuccas, alluvial fans, Joshua tree woodlands, barren washes, shrub-steppe, and blackbrush and juniper woodland ecotones (Berry 2008, USFWS 2008). While it has been historically believed that optimal tortoise habitat occurred in an elevation range of approximately 300 to 900 meters, (1,000 to 3,000 feet) more recent studies and data have found that tortoises may

be more abundant at higher elevations than lower elevations. Soils within the tortoise's habitat must be friable for easy burrowing, but still firm enough to prevent burrows from collapsing (USFWS 2008, CDFG 2010). The status of desert tortoises is discussed in greater detail below.

Amphibians

Most of the HGLA does not contain habitat that would support amphibian species. However, the northwest corner of the HGLA, generally in the drainage below the South Haiwee Reservoir and in the area around Rose Spring, may contain ephemeral drainages that could potentially be occupied by amphibians when water is present. Riparian woodlands and wetlands also occur nearby around Little Lake and the South Haiwee Reservoir. Common amphibians that could occur in these areas are California toad (*Anaxyrus boreus halophilus*) and California tree frog (*Pseudacris cadaverina*).

Fish

Because permanent natural surface waters are absent, no fish species occur within the boundaries of the HGLA.

3.7.2.3 Protected and Sensitive Species

Special Status - Plants

Although no biological field surveys were conducted as part of the current analysis of the HGLA, more than 20 species of special status plants are known to occur in the region surrounding the HGLA; none of the special status plant species have been identified within the HGLA. Only two species have a low potential to occur in the HGLA: Ripley's cymopterus and Charlotte's phacelia.

Charlotte's phacelia (*Phacelia nashiana*) is an annual herb in the Waterleaf Family (Hydrophyllaceae). This species blooms during March to June, and occurs on sandy to rocky, granitic slopes, typically in association with Joshua tree woodland, *Larrea tridentata*-*Ambrosia dumosa* Shrubland Alliance (Mojavean desert scrub) and pinyon and juniper woodland, at elevations of 1,969 to 7,218 feet (Hickman 1993, CNPS 2010). It is a California Native Plant Society (CNPS) California Native Plant Rank species and BLM sensitive species, and its continued existence is reportedly threatened by grazing and mining.

Ripley's cymopterus (*Cymopterus ripleyi* var. *saniculoides*) is a perennial herb. This species occurs on sandy soil, at elevations of 3,200 to 5,312 feet (Hickman 1993, CNPS 2010), typically in association with *Yucca brevifolia* Woodland Alliance and *Larrea tridentata*-*Ambrosia dumosa* Shrubland Alliance. It is a CNPS California Native Plant Rank species and BLM sensitive species. Ripley's cymopterus is expected to occur in the HGLA (G. Harris, personal communication, 2010).

Special Status - Wildlife

The presence, or potential presence, of special-status species and sensitive biological resources was identified primarily through a literature review and agency contacts. Available records for wildlife species indicate that one federally listed threatened species, one state-listed endangered species, four state-listed threatened species, and five BLM Sensitive Species have been reported for the HGLA or surrounding region. General habitat descriptions for these species are included in Appendix D. The HGLA is not within critical habitat of any federally listed species.

Three special status species are known to occur in the HGLA, including burrowing owl, desert tortoise, and Mojave ground squirrel. Because of their known occurrence and potential to be impacted by future developments, more detailed descriptions of each species are provided below.

Because no field surveys were conducted for this programmatic EIS, the expected status and distribution of these species in the HGLA and vicinity was based on the presence and distribution of potentially suitable habitat, and on existing records. Each species was assigned a “probability to occur” status based on HGLA habitats and their known occurrences in the vicinity. The following definitions for probability of occurrence are used:

- **Present:** Recent observations, potentially suitable habitat and presence confirmed with wildlife agencies.
- **High:** Observed in similar habitat in region by qualified biologists, or often occurs in habitat similar to that on the HGLA, and within the known range of the species.
- **Moderate:** Reported sightings in surrounding region, or site is within the known range of the species, and species often occur in habitat similar to that on the site.
- **Low:** Site is within the known range of the species but onsite habitat is largely unsuitable.
- **Absent:** No suitable habitat noted during field surveys and/or via aerial imagery, or the site is well outside known geographic or elevation ranges.

Burrowing Owl

In California, the burrowing owl is listed as a “Bird of Conservation Concern” by the USFWS, as a “Species of Special Concern” by the CDFG, and as “Sensitive” by the BLM. Its range in California includes most of the state, with its wintering range mainly along the coast and the edges of the Central Valley, its summer range in northeast California, and its year-round range comprising the interior of the Central Valley and

most of southern California, including the Mojave and Sonoran Deserts (CDFG 2008). It resides in dry, open habitats, including shortgrass prairies and open patches in annual grasslands, and on disturbed lands, golf courses, airports, and vacant lots. The presence of mammal burrows is a necessary habitat component for burrowing owls (Haug et al. 1993). Burrowing owls also use abandoned tortoise burrows. Burrowing owls are active year-round and, while some may migrate out of the state, most remain as year-round residents of California (CDFG 2008). Burrowing owls are present on a portion of the HGLA.

Several burrowing owl occurrences have been documented in the southern portion of the HGLA as well as within and east of Rose Valley (CDFG 2009). There are at least 53 records of burrowing owls for the WEMO Planning Area, although they are apparently scarce from the eastern Mojave Desert through Inyo County (BLM 2005). The total breeding population in the WEMO Planning Area is estimated to be a few hundred pairs.

Desert Tortoise

The desert tortoise is listed as “Threatened” by the USFWS and the CDFG. Its range includes the Mojave and Sonoran Deserts. It is most common in Mojave creosote bush scrub, desert wash, and Joshua tree habitats, though it occurs in almost every desert habitat below 3,500 feet in elevation. The Desert tortoise requires friable soil for burrowing. Diets typically consist of herbs, grasses, cactus, and wildflowers, and foraging occurs mainly in the spring before aestivation in the summer. Desert tortoises emerge again in the fall with the cooler weather. Aestivation occurs again in the winter (Jennings, 1997). Desert tortoises are expected to occur on the HGLA since a number of local records of occurrence exist (CNDDDB 2009), and suitable habitat is present in the northern portion of the HGLA (USFWS 2009).

According to the USFWS, the desert tortoise is the only federally listed species that may be present in the HGLA (USFWS 2009). The known range of the desert tortoise includes Indian Wells Valley and Rose Valley (LaBerteaux 2009, BLM 2005). According to the USFWS, desert tortoises also occur in areas dominated by lava substrate (USFWS 2009c).

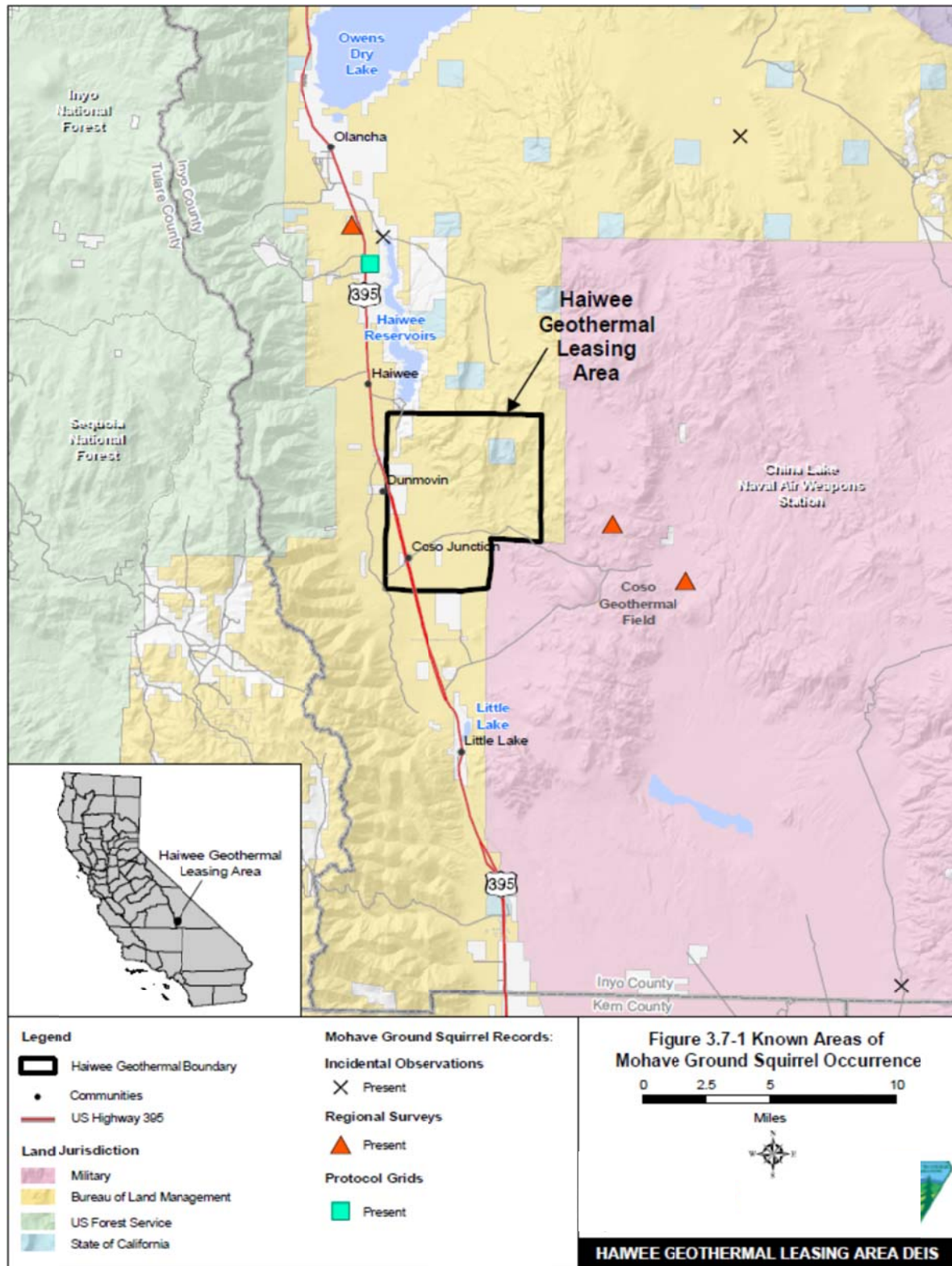
Mojave Ground Squirrel

The Mojave ground squirrel is listed as Threatened by the State of California (CDFG 2009). Its range extends from Lucerne Valley to the southeast, Olancho to the northwest, and the Avawatz Mountains to the northeast; known areas of occurrence are shown on Figure 3.7-1. It is a diurnal species restricted to the Mojave Desert that lives in open desert scrub, alkali scrub, and Joshua tree woodland, primarily feeding on leaves and seeds of forbs and shrubs. It prefers sandy to gravelly soils, avoiding rocky areas and creating burrows at the base of shrubs for cover and nesting. Mojave ground squirrels

enter aestivation in July or August, and emerge from February to June (Bartholomew, Hudson 1960).

The northern part of the Mojave ground squirrel geographic range is in Inyo County, and in the vicinity of Olancho and Haiwee Reservoir (Leitner 2008). Most trapping records come from the Coso region on China Lake NAWS. Two Mojave ground squirrel populations have been monitored at two sites just east of the HGLA in the Coso Range, and research by P. Leitner documents the presence of the Mojave ground squirrel within the HGLA (Leitner and Leitner 1989, 1990; Leitner et al. 1997). In addition, the majority of the HGLA supports potentially suitable habitat (personal communication, Shelley Ellis, BLM). As such, Mojave ground squirrels are expected to occur on portions of the HGLA.

Figure 3.7-1 Known Areas of Mojave Ground Squirrel Occurrence



3.8 CULTURAL RESOURCES

3.8.1 Applicable Regulations, Plans, Policies/Management Goals

A cultural resource is an object or definite location of human activity, occupation, use, or significance identifiable through field inventory, historical documentation, or oral evidence. Cultural resources are prehistoric, historic, archaeological, or architectural sites, structures, buildings, places, or objects and locations of traditional cultural or religious importance to specified social and/or culture groups. Cultural resources include the entire spectrum of objects and places, from artifacts to cultural landscapes, without regard to eligibility for inclusion on the National Register of Historic Places (NRHP) or California Register of Historical Resources (CRHR).

The Cultural Resource Element of the CDCA Plan provides the following goals for the management of archaeological and historical resources. The stated CDCA Plan goals for archaeological and historical resources include:

- Broaden the archaeological and historical knowledge of the CDCA through continuing inventory efforts and the use of existing data. Continue the effort to identify the full array of the CDCA's cultural resources.
- Preserve and protect a representative sample of the full array of the CDCA's cultural resources.
- Ensure that cultural resources are given full consideration in land use planning and management decisions, and ensure that the BLM-authorized actions avoid inadvertent impacts.
- Ensure proper data recovery of significant (National Register quality) cultural resources where adverse impacts cannot be avoided.

The most relevant federal historic preservation law applicable to the HGLA is the NHPA. Section 106 of the NHPA and its implementing regulations (36 CFR part 800) have procedures for considering the effects of proposed federal undertakings on historic properties (i.e., significant cultural resources included or eligible for inclusion on the National Register of Historic Places [NRHP]). Procedures are provided for identifying cultural resources; evaluating their NRHP eligibility; assessing effects; implementing measures to avoid or mitigate adverse effects; and consulting with the Advisory Council on Historic Preservation (ACHP), the SHPO, Native American groups and other interested parties.

3.8.2 Affected Environment

Section 304 of the NHPA and Section 9 of the Archaeological Resources Protection Act (ARPA) provide that information about cultural resources may be kept confidential to protect

them from threats, such as looting or vandalism. For this reason, this section provides a general discussion of the nature and extent of cultural resources within the HGLA.

For this EIS, archaeological and historical resources have been divided into two major categories: archaeological sites and architectural resources (or the built environment). Archaeological sites are locations where human activity has measurably altered the earth or left deposits of physical remains (e.g., stone tools, building foundations, bottles, cans). The architectural, or built environment, includes standing buildings (e.g., houses, outbuildings) or intact structures (e.g., dams, canals, bridges). Traditional cultural places (TCPs) are properties that are important to a community's traditional practices and beliefs, and for maintaining the community's cultural identity (Parker and King 1998). A "historic property" is a specific term used to describe any cultural resource - a prehistoric or historic district, site, building, structure, or object – which is included in, or eligible for inclusion in, the National Register of Historic Places maintained by the Secretary of the Interior.

3.8.2.1 Prehistory

Approximately 10,000 to 20,000 years ago, humans first camped along the ancient rivers and lakes of the Mojave Desert. Early prehistoric groups subsisted on lakeshore plants and animals and on large, now-extinct mammals. By 6,000 BC, the last of these ancient rivers and lakes disappeared due to extreme aridity. The once bountiful grasslands and marshes that occupied the shores of these waters and the large game that visited the lakes and rivers vanished. As a result, prehistoric human populations abandoned low-lying desert areas and moved to upland areas in search of food and water. Around 4,000 BC, the region experienced another shift in climatic conditions from the extreme aridity of the preceding period to the more moderate conditions prevalent today (BLM 2007a). Native Americans adapted to the changing environment by altering food sources, modifying settlement patterns and hunting and gathering strategies, and adopting new tools.

3.8.2.2 Historic Period

Ethnographic Background and Context

During the 18th and 19th centuries, indigenous groups in the California deserts typically had fluid linguistic, cultural, and socio-political boundaries, or no boundaries at all. The HGLA lies within the traditional 19th century territories of the Owens Valley Paiute, the Western Shoshone, the Timbisha Shoshone and the Desert Kawaiisu. All four groups were hunter-gatherers with similar material culture. Each may have lived in or used plants, animals, and other natural resources in the HGLA.

After the Spanish began colonizing coastal California in 1769, indigenous groups, including those far from the coast, were subject to dramatic social, cultural, and demographic changes caused by the establishment of the Spanish mission system and the introduction of new diseases. Indigenous populations declined even further during smallpox epidemics in 1863 and 1870.

Historic Background and Context

Euro-American settlement and development of the region encompasses four major themes – mining, ranching, construction of the Los Angeles Aqueduct, and the development and operation of military facilities.

The discovery of gold in the year 1848 was the beginning of an era in California history marked by an increase in population, trade, and commerce. The Mojave Desert, although remote and inhospitable to most, was as much of a draw for miners as other locations in the state. The first mine in the Mojave Desert was started in 1848 in San Bernardino County, and mining continued elsewhere in the desert, including Inyo County, to this day.

A variety of minerals were extracted from the Mojave Desert, including gold, silver, galena, asbestos, pumice, copper, salt, cinnabar, tungsten, zinc, borax, and lead. Many techniques were employed -- placer mines, stamp mills, shafts, and tunnels. Remnants of all of these practices can be found throughout the Mojave Desert. Although none of the documented mines is in the HGLA, several are located to the north, south, and east. These include Darwin, Coso, the Rand Mining District (including Johannesburg, Red Mountain and Randsburg), Beveridge, Panamint, and the Inyo Mine (Feller n.d.).

In the 1860s, livestock grazing increased in the area. Ranchers used the land primarily for grazing sheep; however, the area was also used for cattle. Much of the sheep use in the area resulted from ‘sheep trailing’, or the movement of herds from southern winter and spring ranges north through the area to summer ranges. By the 1870s, both cattle and sheep grazing in the area had peaked and begun to decline (Powers 1988; Clel 1972; Harris 2010).

The Los Angeles Aqueduct crosses the northwestern corner of the HGLA and diverts water from the Owens River immediately to the north. Early in its history, the City of Los Angeles recognized that its population growth was rapidly outpacing water availability. In 1904, William Mulholland, the superintendent of the Los Angeles city water company, identified the Owens River as a new source of water for the city. In 1908, construction began on a pipeline and reservoirs that would divert water from this new source. Haiwee Reservoir, north of the HGLA, was the largest of the reservoirs. By 1913 the First Los Angeles Aqueduct was completed. However, by 1924 the water from the Owens River was rapidly disappearing, and the City began to tap the ground water. By the 1930s another location had

been identified as a major water source and the Mono Basin Project was born. The Second Los Angeles Aqueduct was built in 1970 (LADWP n.d.).

A Naval Ordnance Test Station (NOTS) was established at China Lake on November 8, 1943. The creation of NOTS was born out of a need for adequate facilities to test and evaluate rockets being developed for the Navy during World War II. The Navy also needed a new proving ground to test other weaponry. Now known as the China Lake Naval Air Weapons Station (NAWS), the northern unit of this facility borders the HGLA

3.8.3 Existing Conditions

3.8.3.1 Cultural Resources in the Vicinity of the HGLA

No field investigations were performed for this EIS. If future geothermal projects are proposed for the HGLA, the BLM will require the permit applicants to perform project-specific inventories for cultural resources in compliance with Section 106 of the NHPA. For this EIS, the analysis of cultural resources in the HGLA was based on background information from a variety of sources, including:

- Records on file at the Ridgecrest Field Office of the BLM.
- Records and field maps at the Eastern Information Center (EIC), a unit of the California Office of Historic Preservation (OHP) California Historical Resources Information System (CHRIS), at the University of California, Riverside.
- The National Historic Landmarks (NHL) Survey of the National Park Service (NPS).
- The online database of the NRHP.
- Information maintained by the OHP on California Historical Landmarks (CHL), properties listed in the California Register of Historical Resources (CRHR), and California Points of Historical Interest.
- A list provided by the EIC of the CRHR and NRHP eligibility status of archaeological resources in Inyo County.
- Information obtained through consultation with consulting parties, including Indian tribes.

National Historic Landmarks

NHLs are nationally significant historic places designated by the Secretary of the Interior for their exceptional value or quality in illustrating or interpreting the heritage of the United States. Two NHLs are located in Inyo County:

- Manzanar War Relocation Center, along US 395 north of Lone Pine, 45 miles north of the Haiwee leasing area.
- Coso Rock Art District, located within China Lake NAWS about 10 miles east of the HGLA.

National Register of Historic Places

To be listed in or considered eligible to the NRHP, a cultural resource must be significant under criteria established by the Secretary of the Interior in 36 CFR 60.4. The NRHP online database was reviewed on November 13, 2009, to determine whether any NRHP-listed properties are in or near the HGLA. Listed properties in the vicinity include:

- Coso Rock Art District, within China Lake NAWS east of the HGLA (also an NHL).
- Ayers Rock Petroglyph Site (CA-INY-134), less than one mile from the HGLA.
- Coso Hot Springs, on China Lake NAWS, east of the HGLA.
- Fossil Falls Archaeological District, in the Little Lake vicinity south of the HGLA.

California Historical Landmarks

CHLs are buildings, structures, sites, or places determined to have statewide historical significance. CHLs numbered No. 770 and higher are also automatically listed in the CRHR.

The list of CHLs maintained by the OHP was reviewed on November 13, 2009. The list identifies 21 CHLs in Inyo County, only two of which are located in the vicinity of the HGLA:

- Farley's Olancho Mill Site (No. 796) near Olancho, about 10 miles north of the HGLA.
- Fossil Falls Archeological District (No. N888), near Little Lake about four miles south of the HGLA (also listed in the NRHP).

California Register of Historical Resources

The State Historical Resources Commission has designed the CRHR program for use by state and local agencies, private groups, and citizens to identify, evaluate, register, and protect California's historical resources. Based on the OHP's list of Inyo County resources on the CRHR, the only ones listed are the two CHLs in the vicinity, Farley's Olancho Mill and Fossil Falls Archaeological District, both well outside the HGLA.

California Points of Historical Interest

California Points of Historical Interest are sites, buildings, features, or events of local (city or county) significance and have anthropological, cultural, military, political, architectural, economic, scientific or technical, religious, experimental, or other value. Points of Historical Interest designated after December 1997, and recommended by the State Historical Resources Commission, are also listed in the California Register.

Information on California Points of Historical Interest was obtained from the OHP's web site. Of nine Points of Historical Interest in Inyo County, none are within or near the HGLA.

BLM Areas of Special Designation

In 1985, the BLM established the Rose Spring Area of Critical Environmental Concern (ACEC) to protect significant prehistoric archaeological sites for scientific use and public interpretation. Portions of the Rose Spring ACEC are within the HGLA.

Sites of Religious or Cultural Significance to Indian Tribes

Information about sites that Indian tribes attach religious or cultural significance is generally identified through existing ethnographic information and consultation with Indian tribal governments. No specific TCPs, archaeological sites, locations of important historic events, sacred sites, and sources of raw material used to make tools or sacred objects, or traditional hunting and gathering areas have been identified within the HGLA in the ethnographic literature or through consultation.

3.8.3.2 Recorded Cultural Resources within the HGLA**Previous Surveys**

A review of previous cultural resource surveys within the boundaries of the HGLA shows that 1,500 to 2,000 acres out of the total area of over 24,000 acres, or six to eight percent, have been systematically and intensively surveyed for cultural resources. Because of the small amount of intensive survey, most cultural resources in the HGLA are not expected to have been identified.

Known and Recorded Cultural Resources

Maps at the BLM Ridgecrest Field Office and the EIC in Riverside show at least 218 cultural resources within the boundaries of the HGLA, most of which are archaeological sites. Most of these cultural resources have not been evaluated for NRHP eligibility. Twenty cultural resources have been either recommended as eligible, or determined eligible, for listing in the NRHP. There are 110 cultural resources for which chronological information is available, 95 of which are exclusively prehistoric archaeological sites and seven of which are historic archaeological sites. Eight sites contained both historic and prehistoric archaeological

components. The majority (about 80 percent) of the prehistoric archaeological sites can be characterized as lithic scatters, or surface scatters of chipped stone flakes and tools. They range in size from small, low density surface scatters to archaeological sites containing thousands of obsidian flakes. Fourteen percent of the prehistoric archaeological sites also had milling features (for grinding plant foods). Other prehistoric archaeological sites have ground stone artifacts, rock shelters, rock cairns, or evidence of quarrying. Two previously recorded archaeological sites reported the presence of human remains or burials.

A notable prehistoric archaeological site within the HGLA is site CA-INY-372. This site contains a large and diverse concentration of lithics, groundstone, features, and other diagnostic artifacts. The age of the occupations at the site extend from approximately 1950 BC to AD 1700. The site has been severely impacted by looting and vandalism, as well as construction of the Los Angeles Aqueduct, but intact portions of the site remain. Under the guidance of the CDCA Plan, an area surrounding and including the site has been established as an ACEC by the BLM.

Recorded historic period resources are much less common in the HGLA than prehistoric archaeological resources. Historic period cultural resources that have been recorded within the planning area include a trail, mining and other debris, a rock wall, graffiti, and wooden structures. One architectural resource, the Haiwee Power Plant, lies north of the HGLA.

Judging from known and recorded historic period cultural resources in the HGLA, most unrecorded historic period resources are expected to be related to mining, the construction of the Los Angeles Aqueduct, or construction or use of thoroughfares such as the Coso Junction Road and railroads.

Based on the distribution of known cultural resources and the limited number of past surveys in the HGLA, it is anticipated that the portion of the leasing area most likely to contain significant cultural resources would include Rose Valley, especially near existing or former lakes. In the hills to the east, locations near springs and along drainages would be most likely to contain significant archaeological resources, while very steep terrain and locations far from drainages would be less likely to have supported past human activities and have little surviving physical evidence of past activities.

3.9 PALEONTOLOGY

3.9.1 Applicable Regulations, Plans, Policies/Management Goals

The Cultural Resource Element of the CDCA Plan identifies the following general goals for the management of Paleontological Resources:

- Ensure that paleontological resources are given full consideration in land use planning and in management decisions.
- Preserve and protect a representative sample of the full array of the CDCA's paleontological resources.
- Ensure proper data recovery of significant paleontological resources where adverse impacts cannot be avoided or otherwise mitigated.

Federal laws that protect paleontological resources include NEPA, FLPMA, and the Paleontological Resource Preservation Act (PRPA) (Public Law 111-011 Subtitle D). PRPA was passed as part of the Omnibus Public Land Management Act of 2009. Land managing agencies are currently in the process of developing guidelines and procedures to implement PRPA. Several key features of PRPA include the definition of paleontological resources, a mandate to manage paleontological resources on federal lands using scientific principles and expertise, criteria for issuing permits to collect paleontological resources, definitions of specifically prohibited acts, specific penalties for violations, and an exemption of specific paleontological locality data from Freedom of Information Act (FOIA) requests. Overall, PRPA gives federal land managing agencies the authority to specifically protect and manage paleontological resources on federal lands.

3.9.2 Affected Environment

Paleontological resources, or fossils, are the remains or traces of once-living organisms preserved in rocks and sediments. Such resources include bones, teeth, shells, wood, leaf impressions, footprints, burrows, and microscopic remains, among others. Fossils are considered non-renewable resources because the organisms from which they derive no longer exist. Once destroyed, a fossil can never be replaced.

Fossils are important because they are used to understand:

- Extinction and speciation.

- The relationships between extinct organisms and modern species.
- Ancient environments, climate change, and paleo-ecology.
- Geologic dating, which is an independent and line of evidence for isotopic dating.
- The geographic distribution of organisms.
- Tectonic movements of land masses and ocean basins.

3.9.3 Existing Conditions

No paleontological field investigations were performed for this EIS.

Occurrences of paleontological resources are closely tied to the geologic units (i.e., formations, members, or beds) that contain them. The probability of finding paleontological resources can be broadly predicted from the geologic units present at or near the surface. For example, the Pliocene (4.8 to 3.0 million years ago) Coso Formation in Death Valley is known to contain fossils of mastodon, horse, zebra, peccary, and dog. Coso Formation deposits are found in the eastern part of the HGLA (Whitmarsh 1997), although fossils have not been reported in that area. Pleistocene (2.6 million years ago to 12,000 years ago) fossils have been found at Owens Lake north of the HGLA.

Fossil discoveries in the immediate vicinity of the HGLA are rare (D. Storm 2009, personal communication). However, a mammoth fossil was reportedly collected at the dam site of North Haiwee Reservoir (two miles north of the HGLA) by William Mulholland during construction of the Los Angeles Aqueduct (Cogstone 2007).

Despite its name, Fossil Falls Archaeological District does not contain fossils. The feature was formed 20,000 years ago when glacial meltwater from Owens Lake was forced over much older basalt flows.

Overall, there appears to be very little potential for the occurrence of paleontological resources within the HGLA (D. Storm 2009, personal communication). The reasons are:

1. The Sierra Nevada to the west is granitic.
2. The Coso Range to the east is mostly volcanic.
3. The valley floor is mostly Pleistocene and Holocene alluvial and fluvial deposits.

4. The remainder of the valley floor is Coso volcanics with basalts and rhyolite.
5. Owens River gravel deposits are too young to contain paleontological material.

3.10 VISUAL RESOURCES

3.10.1 Applicable Regulations, Plans, Policies/Management Goals

The following federal, state, and local laws, ordinances and regulations (LORs) provide guidelines for the management of visual resources in the HGLA.

3.10.1.1 Federal - Bureau of Land Management Ridgecrest Field Office

California Desert Conservation Area Plan of 1980, as Amended

The Ridgecrest Field Office is part of the California Desert District, which is included in the CDCA. The California Desert Conservation Area Plan of 1980, as amended, states in Chapter 3, Recreation Element, Visual Resources Management Program page 72 that:

- “Appropriate levels of management, protection, and rehabilitation on all public lands in the CDCA will be identified, commensurate with visual resource management objectives in the multiple-use class guidelines.”
- “Proposed activities will be evaluated to determine the extent of change created in any given landscape and to specify appropriate design or mitigation measures using the Bureau’s contrast rating process.”

West Mojave Plan (2006)

The West Mojave Plan Record of Decision (2006) and the Final Environmental Impact Report and Statement for the West Mojave Plan (2005) do not include regulations or standards pertaining to visual resources.

3.10.1.2 Applicable State Regulations

California Environmental Quality Act (CEQA)

CEQA was enacted in 1970. CEQA provides a process for determining a program or action’s potential effect on the environment, and developing measures to minimize those effects. California Public Resources Code, Section 21060.5 states that “Environment means the physical conditions which exist within the area which will be affected by a

proposed project, including land, air, water, minerals, flora, fauna, noise, and objects of historic or aesthetic significance.”

To determine the significance of potential effects under CEQA, Appendix G of the Act was referenced. The guidelines indicate that a program or project will have a significant effect on the environment in relation to visual resources if it will:

- Have a substantial, adverse effect on a scenic vista.
- Damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway.
- Substantially degrade the existing visual character or quality of the site and its surroundings.
- Create a new source of substantial light or glare that would adversely affect day or nighttime views in the area.

California Scenic Highway Program

The goal of the California Scenic Highway Program is to preserve and enhance the natural beauty of California. California contains several distinct landscape regions and the merits of a particular landscape are considered within the context of its own region. The highway should traverse an area of outstanding scenic quality, containing striking views, flora, geology, or other unique natural attributes. Therefore, Caltrans evaluates the merits of a nominated highway on how much of the natural landscape a traveler sees and the extent to which visual intrusions impact the "scenic corridor." Visual intrusions may be natural or constructed elements, viewed from the highway, that adversely affect the scenic quality of a corridor. Adverse affects are characterized as minor, moderate, or major. Visual intrusions are evaluated in the following manner:

- The more pristine the natural landscape is and less affected by intrusions, the more likely the nominated highway will qualify as scenic.
- Where intrusions have occurred, the less impact they have on an area's natural beauty, the more likely the nominated highway will qualify as scenic.
- The extent to which intrusions dominate views from the highway will determine the significance of their impact on the scenic corridor.

Scenic highway nominations are evaluated using the following criteria:

- The state or county highway consists of a scenic corridor that is comprised of a memorable landscape that showcases the natural scenic beauty or agriculture of California.
- Existing visual intrusions do not significantly impact the scenic corridor.
- Demonstration of strong local support for the proposed scenic highway designation.
- The length of the proposed scenic highway is not less than a mile and is not segmented.

When Caltrans determines a proposed scenic highway satisfies these qualifications, the local governing body, with citizen support, must adopt a program to protect the scenic corridor. The zoning and land use along the highway must meet the state's legislatively required elements for scenic highway corridor protection.

An eligible highway may be nominated for official designation by the local governing body with jurisdiction over the lands adjacent to the proposed scenic highway. The application to nominate eligible scenic highways for official designation requires the preparation of a visual assessment and Scenic Highway Proposal. The proposal must include a letter of intent from the local governing body, topographic and zoning maps, and a narrative description of the scenic elements in the corridor that includes a discussion of any visual intrusions on scenic views.

This step requires the local governing body to develop and adopt protection measures in the form of ordinances, zoning, and/or planning policies that apply to the area of land within the scenic corridor. When there is more than one governing body involved, each jurisdiction shall jointly submit protection measures. An effective protection program ensures that activities within the scenic corridor are compatible with scenic resource protection and consistent with community values, while still allowing appropriate development. The five legislatively required elements of corridor protection are:

- Regulation of land use and density of development (i.e., density classifications and types of allowable land uses);
- Detailed land and site planning (i.e., permit or design review authority and regulations for the review of proposed developments);

- Control of outdoor advertising (i.e., prohibition of off-premise advertising signs and control of on-premise advertising signs);
- Careful attention to and control of earthmoving and landscaping (i.e., grading ordinances, grading permit requirements, design review authority, landscaping and vegetation requirements); and
- The design and appearance of structures and equipment (i.e., design review authority and regulations for the placement of utility structures, microwave receptors, wireless communication towers, etc.).

3.10.1.3 Applicable Local Regulations

Inyo County General Plan (2001)

Lands under private ownership exist within and adjacent to the HGLA. Applicable management plans and policies for these lands include the Inyo County General Plan (Inyo County 2001). As Inyo County has no direct land use jurisdiction over public lands, the General Plan is not directly applicable to activities proposed on public lands. However, private lands scattered and adjacent to the HGLA are under Inyo County's jurisdiction and therefore would be subject to the General Plan and County ordinances if they are used in any future geothermal development on federal lands.

The Inyo County General Plan includes goals, policies, and implementation measures pertaining to visual resources. Chapter 7, Circulation Element, Section 7.3, Scenic Highways, includes goals policies and implementation measures that address issues related to scenic highways. Chapter 7 Section 7.3.4 Policy SH-1.3, Expand Scenic Route Designations states the following:

The County will work with Caltrans to obtain scenic route designations on all portions of US 395 and State Roads 168 and 190. The County should also work with Caltrans to identify and have designated other scenic corridors in the County.

Chapter 8 Conservation/Open Space Element Section 8.8, Visual Resources, covers the protection of visual resources in Inyo County. Goal VIS-1 states the following:

Preserve and protect resources throughout the County that contribute to a unique visual experience for visitors and quality of life for County residents.

3.10.2 Affected Environment

The HGLA is bounded by the Sierra Nevada Mountains, which rises steeply to the west and the Coso Range to the east. The China Lake NAWs is located to the east and South Haiwee Reservoir is located to the north. The elevation ranges from 1,355 to 4,440 feet above mean sea level.

The visual resources inventory describes the regulatory framework for managing visual resources in the HGLA, landscape character of the region, scenic quality of the landscape, visibility of the landscape from sensitive viewpoints (e.g., communities, recreation and preservation areas, and roadways), and BLM visual resource inventory and visual resource management classes.

The BLM conducted a Visual Resource Management Inventory study in the fall of 2009 to determine visual management goals for the HGLA and incorporate the results into this EIS as well as use them for future planning decisions in the area (Clayton 2009). The Visual Resource Management Inventory report generated by this study identified scenic quality rating units, sensitive viewpoints, and Visual Resource Inventory (VRI) classes for the HGLA, which the BLM may establish as interim Visual Resource Management (VRM) classes in this EIS.

In addition, the Cultural Resources section of this document (Section 3.8) identified several cultural resources within or near the HGLA that may be sensitive to changes in visual setting. These are discussed briefly below.

3.10.1.4 Inventory Methods

Visual resources were inventoried within the HGLA. The study was conducted in compliance with the BLM Visual Resource Management Inventory and Contrast Rating System (BLM 1986a and b). The visual resources inventory consisted of the following sequence of tasks:

- Review of the regulatory framework in place for the HGLA;
- Review of the previously completed the BLM Visual Resource Management Inventory for the HGLA, including VRI classes and scenic quality classes (Clayton 2009);
- A review of the regional physiography and landscape character;
- Identification of sensitive viewpoints; and
- Identification of distance zones and visibility from sensitive viewpoints.

3.10.1.5 Data Sources

Visual resources data was obtained from the Visual Resource Management Inventory (Clayton 2009). Visual resource data was collected from agency and government publications including the BLM Ridgecrest Field Office, CDCA Plan of 1980, as amended, and the Inyo County General Plan (2001); agency websites including the BLM Ridgecrest Field Office website, the Inyo National Forest Website, the Inyo County website, and the California Department of Transportation website; and GIS data sets including Inyo National Forest mapping, base mapping previously collected by POWER Engineers (roadways, topography, transmission lines, jurisdiction and ownership, etc.), and GIS data sets from the Visual Resource Management Inventory. Aerial photography and topography modeling from Google Earth was also reviewed. Field reconnaissance was conducted during the Visual Resource Management Inventory. No additional field reconnaissance was conducted for this EIS.

3.10.1.6 Data Categories

Regional Setting and Landscape Character

The inventory of the aesthetic value of the landscape began by examining the physiography and cultural modifications of the region. Physiography, also referred to as geomorphology, is the classification of landforms according to their geologic structures and histories into three tiers: divisions, provinces and sections. Patterns of cultural modification were also identified and categorized.

The HGLA, while within the Mojave Desert geographic area, additionally occupies two physiographic provinces. The majority of the HGLA is within the Great Basin Section of the Basin and Range Province while the southwest corner of the HGLA is within the Sierra Nevada Section of the Cascade-Sierra Mountains Province.

The HGLA is generally comprised of undeveloped desert with naturally-vegetated areas. US 395, a primary north-south highway, traverses the Rose Valley, the Coso-Gill Station Road traverses the area from west to east, and several unimproved roads also provide access to the area. A number of small communities are also located within and/or in the vicinity of the action area. These communities include Olancho, Haiwee, Dunmavin, Coso Junction and Little Lake.

Basin and Range Province

Great Basin Section

The Great Basin Section is characterized as “isolated ranges (largely dissected block mountains) separated by aggraded desert plains” (Fenneman 1931). The region generally consists of an alternating pattern of linear mountain ranges and desert valleys, created by roughly north-south trending faults, with the mountains typically occupying half of the surface area. The ranges are typically 50 to 75 miles in length, with jagged crests that tend to be relatively even in height and width. The Great Basin has no external outlet, consisting of independent basins with water features generally consisting of internally drained streams and ephemeral playa lakes on the valley floor of each drainage. Vegetation in the valleys tends to be sagebrush where absolute desert conditions do not occur. The mountains are typically desert, although pinyon or dwarf cedars, mountain mahogany, and yellow pine may occur on the slopes where conditions are favorable and adequate water is available.

Predominant natural communities may include the Big sagebrush series, Singleleaf pinyon series, Utah juniper series, Low sagebrush series, Shadscale series, *Atriplex confertifolia* alliance, Mixed saltbrush series, and Bristlecone pine series (USFS Pacific Southwest Region ND). Most of these communities do not occur in the project area, but may, in some cases, be visible from within the HGLA.

Cascade- Sierra Mountains Province

Sierra Nevada Section

The Sierra Nevada Section is characterized as “block mountain range tilted west; accordant crests; alpine peaks near east side” (Fenneman 1931). The area consists of a mountain barrier, with an average width of 50 to 60 miles, between the plateaus on the east and the Pacific valleys on the west. The range consists primarily of granitic rock. Unlike the northern portion of the Sierra Nevada, the southern portion (where the HGLA is located) contains little evidence of past glaciation.

Predominant natural communities in this section may include the Mixed conifer series, Ponderosa pine series, Jeffrey pine series, White fir series, Red fir series, Lodgepole pine series, Huckleberry oak series, Western Juniper series, Aspen series, Big sagebrush series, Mixed subalpine forest series, Mountain hemlock series, Whitebark pine series and Giant sequoia series (USFS Pacific Southwest Region ND). These communities do not occur in the project area, but may, in some cases, be visible from within the HGLA.

Scenic Quality

Scenic quality mapping was obtained from the Visual Resources Management Inventory (Clayton 2009).

Scenic quality is a measure of the visual appeal of a tract of land. The BLM uses a numerical rating system to determine scenic quality classes. The system classifies the landscape into three levels of scenic quality: Class A, Class B, and Class C using seven key factors: landform, vegetation, water, color, adjacent scenery scarcity, and cultural modifications. The three classes of scenic quality are defined as follows:

Class A – Distinctive

Areas where characteristic features of landform, rock, water and vegetation are distinctive or unique in the context of the surrounding areas. These features exhibit considerable variety in form, line, color and texture and have strong positive attributes of unity and intactness.

Class B – Above Average

Areas in which features provide variety in form, line, color and texture. Although the combinations are not rare in the surrounding region, they provide sufficient visual diversity to be considered moderately distinctive. These features exhibit more common variety in form, line, color and texture and have positive, but more common attributes of unity and intactness.

Class C – Common

Areas where characteristic features have moderate to little variety in form, line, color and texture in relation to the surrounding region.

Sensitive Viewpoints

Potentially sensitive viewpoints, referred to as Key Observation Points (KOPs) in the BLM Visual Resources Management methodology, were identified through agency websites including the BLM Ridgecrest Field Office website, the Inyo National Forest website, and the California Department of Transportation website; land use data; and written and oral scoping comments.

Viewpoints considered include:

- Communities – identified by the land use inventory undertaken for the HGLA.
- Recreation and preservation areas – existing and proposed developed recreation sites, parks or areas used for camping, picnicking or other recreational activities.
- Sensitive travel corridors – proposed or designated scenic or historic highways or byways and recreation destination routes.

- Cultural resources that may be sensitive based on visual resources sensitivity criteria as defined below.

Potential effects to the visual setting of National Historic Landmarks, National Register historic districts and sites, and sites nominated to or designated by the State Historic Preservation Officer are further addressed in the Cultural Resources Section (3.8).

Isolated or dispersed rural residences may occur in or near the HGLA. These isolated residences were not inventoried. However, residences are typically considered highly sensitive to visual change and should be inventoried and assessed in detail for any future action related to geothermal resource development within the HGLA.

The visual sensitivity of identified viewpoints was evaluated and rated as high, moderate, or low, following established BLM criteria. Criteria are listed below in Table 3.10-1.

Table 3.10-1 Visual Sensitivity Criteria Definitions

Criteria	High	Moderate	Low
User Type/ Attitude	High expectations for maintaining scenic attractiveness (i.e. residences)	Users are concerned for scenic attractiveness but it is not the primary focus of their experiences (i.e., dispersed recreation areas, which are areas where recreation activities may be performed but no designated facilities exist, and general travel corridors).	Areas where the public has low expectations for maintaining scenic attractiveness. Generally commercial or industrial areas where human caused modifications dominate the landscape.
Duration of View	Fixed or continuous views – Long	Intermediate views (i.e., open highway views)	Brief or intermittent views (i.e. highway views in rolling landscapes) – Short
Use Volume	High level of use	Moderate level of use	Low level of use

Visual Sensitivity

Visual sensitivity, or sensitivity level, is defined as a measure of viewer concern for the scenic resource and potential changes to the resource. The BLM identifies KOPs, or sensitive viewpoints by identifying the most critical viewpoints and then considering angle of observation, number of viewers, length of time the project is in view, relative project size, season of use, and light conditions for each viewpoint. The factors most relevant to this study have been condensed into the following criteria to identify sensitivity levels for potential viewpoints.

User type/attitude considers the local, regional or national significance or importance of a viewpoint or viewed area. As an example, national park or wilderness area viewpoints are typically considered more sensitive than an interstate highway.

Duration of view is defined as the length of time that a sensitive viewer would typically encounter a particular view. For example, a view from a residence is considered to be a high duration view because the landscape could be viewed at any time of day and for any length of time. Alternatively, the amount of time the commuter would see an area of landscape from a highway as they drive through the area would be very short, and thus would be considered a short duration view.

Use volume considers the number of users. As an example, a busy arterial road would have a higher volume of users than a small local street.

The combination of user type/attitude, use volume, and duration of view produced an overall sensitivity level of high, moderate, or low that was subsequently used in the visual analysis (see Table 3.10-1). See Table 3.10-2 for a complete list of viewpoints and sensitivity levels. Potential visual impacts were assessed for high sensitivity viewpoints.

Table 3.10-2 Sensitive Viewpoints

Viewpoint	User Type/ Attitude	Duration of View	Use Volume	Visual Sensitivity	Comments
Communities*	High	Long	Moderate	High	Includes Olancho, Haiwee, Dunmovin, Coso Junction and Little Lake
Travel Corridors					
US 395	High	Short	High	High	State Identified Eligible Scenic Highway*
Coso-Gill Station Road	Moderate/Low	Short	Low	Low	
Unimproved/4WD Roads	Moderate/Low	Short	Low	Low	
Mine Haul Roads	Low	Short	Low	Low	
Recreation and Preservation Viewpoints					
Little Lake Overlook*	High	Long	Low	High	California Watchable Wildlife Site

Viewpoint	User Type/ Attitude	Duration of View	Use Volume	Visual Sensitivity	Comments
Fossil Falls*	High	Long	Low	High	One of the Ridgecrest Field Office's 'Top 10 Points of Interest;' campground and trail at site
Sacatar Trail Wilderness*	High	Long	Low	High	Access from the east is via the Sacatar Trail.
Coso Range Wilderness*	High	Long	Low	High	
South Sierra Wilderness*	High	Long	Low	High	
Haiwee Trail*	High	Long	Low	High	Trail accesses Kern River Wild and Scenic River and South Sierra Wilderness
Pacific Crest Trail*	High	Long	Low	High	
Kennedy Meadows Campground*	High	Long	Low	High	Campground provides access to the Pacific Crest Trail
Kern River Wild and Scenic River	High	Long	Low	High	
South Haiwee Reservoir	N/A	N/A	N/A	N/A	The reservoir has been closed to public access.
Cultural Resource Viewpoints					
Rose Spring ACEC	Moderate/Low	Long	Low	Low	Designated for important and irreplaceable cultural resources, especially archaeological.
Ayers Rock Petroglyph Site	Moderate	Long	Low	Moderate	
Coso Hot Springs*	High	Long	Low	High	
Fossil Falls Archeological District*					See Recreation and Preservation Viewpoints

*High sensitivity viewpoints included in the visibility analysis

Visibility and Distance Zones

Distance zones identified by the BLM in the VRM methodology were used for this report. These distance zones are as follows:

- **Foreground-Middleground Zone** (0 to 3 - 5 miles): This is the area where management activities might be viewed in detail. The outer boundary of this distance zone is defined as the point where the texture and form of individual plants are no longer apparent in the landscape.

Perception of detail and dominance of the landscape typically changes greatly between the origin of the foreground-middleground distance zone and its outer boundary. To provide more detailed visibility inventory information, the distance zone has been divided into the following sub zones.

- **Foreground Zone** (0 to 0.5 mile)
- **Middleground Zone** (0.5 to 3-5 miles)
- **Background** (3 - 5 to 15 miles): This is the remaining area which can be seen. Areas which are so far distant that the only thing discernible is the form or outline are not included. In order to be included within this distance zone, vegetation should be visible at least as patterns of light and dark.
- **Seldom Seen**: These are areas that are not visible within the foreground-middleground and background zones, and areas beyond the background zones.

VRM/VRI Classes

Visual resources on BLM lands are managed under the VRM system. VRM Classes define the acceptable degree of visual change allowed in a given landscape. The BLM derives visual management objectives for their lands by evaluating and overlaying the elements of landscape scenic quality with viewer sensitivity and visibility from viewpoints in a given area. The BLM has four VRM Classes to manage visual resources on public lands. The BLM utilizes the VRM system to establish guidelines on managed lands that allow for various levels of change as typically detailed in the BLM Resource Management Plans (RMPs). VRM Classes are as follows:

Class I

The objective of this class is to preserve the existing character of the landscape. This class provides for natural ecological changes; however, it does not preclude very limited

management activity. The level of change to the characteristic landscape should be very low and must not attract attention.

Class II

The objective of this class is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.

Class III

The objective of this class is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.

Class IV

The objective of this class is to provide for management activities which require major modifications of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements.

3.10.1.7 Existing Conditions

Scenic Quality

Refer to Figure 3.10-1 for scenic quality mapping completed for the Visual Resource Management Inventory. Four Scenic Quality Rating Units (SQRU) were mapped, rated, and described in the Visual Resource Management Inventory (Clayton 2009). SQRUs 01 and 02, which make up the majority of the HGLA, were identified as Class C. SQRUs 03 and 04, which are located in the northeast corner of the HGLA, were identified as Class B. The SQRUs were described as follows.

SQRU 01

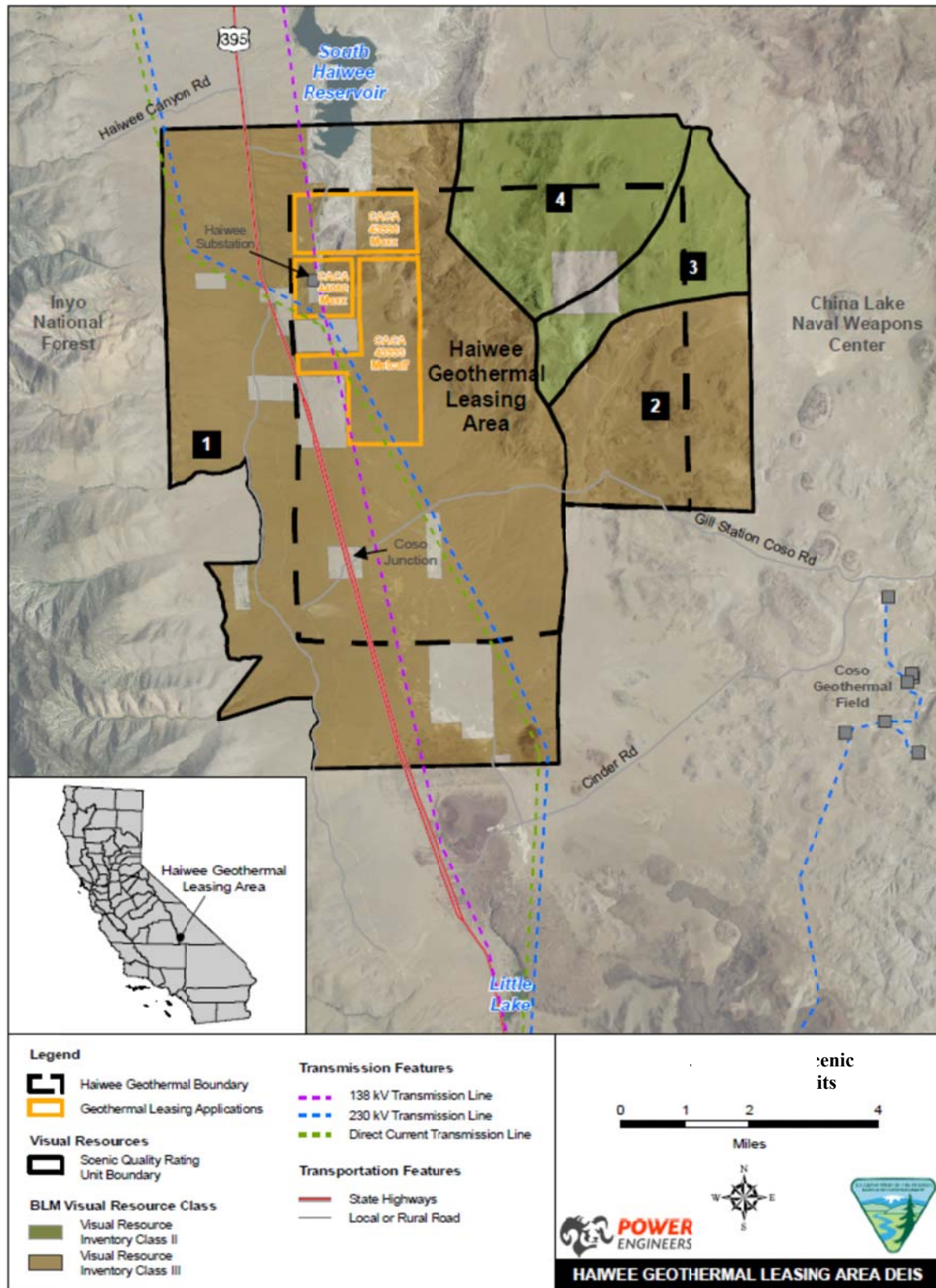
Encompasses a portion of Rose Valley south of South Haiwee Reservoir and east of Inyo National Forest and Sacatar Trail Wilderness. The unit is bisected (north to south) by US 395 and several transmission lines. The western edge of the Valley (and unit) is visually defined by the abruptly rising Sierra Nevada Mountains. The eastern boundary of the

unit is generally defined by the north-south trending ridges and low hills that parallel US 395, three to four miles to the east. The landscape is generally flat, high desert valley with grass and low-growing shrubs of muted brown, tan and green color tones. Also visible (from some vantage points) are several electric transmission lines with complex structural forms and industrial character, and the linear, horizontal form of US 395. Three transmission lines, consisting of a 138 kV line, a 230 kV line, and a 500 kV DC line cross the unit from northwest to southeast. The unit is bordered by rugged, rocky ridges and rolling hills to the east. More distant mountain ranges (Sierra Nevada Mountains to the west and Coso Range to the east) provide a backdrop of visual interest though they are not part of this unit.

SQRU 02

Encompasses an area of low hills and ridges just east of Rose Valley and northeast of Coso Junction. The landscape is generally composed of low, rolling hills with grass and low-growing shrubs and Joshua trees. Colors tend to be muted tones of brown, tan and green. The unit is crossed by several haul roads that service mining operations within and to the east of Unit 02. While built features are generally absent from SQRU 02 (aside from the haul roads), this unit is substantially influenced by the noticeable and frequent haul vehicles passing through the unit. This truck traffic generates considerable dust, which covers much of the vegetation adjacent to the haul roads.

Figure 3.10-1 HGLA Scenic Quality Rating Units



SQRU 03

Encompasses an area of low, rocky hills and ridges, and rock outcrops with scattered Joshua trees, just east of Rose Valley and southeast of South Haiwee Reservoir. The landscape is generally composed of complex desert landforms consisting of low, rocky hills and ridges with prominent rock outcrops and boulder piles. Vegetation includes grass and low-growing shrubs of subdued yellows, greens and tans with scattered Joshua trees. The unit landscape imparts a sense of remoteness that, along with the coherent assemblage of high desert features, enhances visual interest and scenic quality.

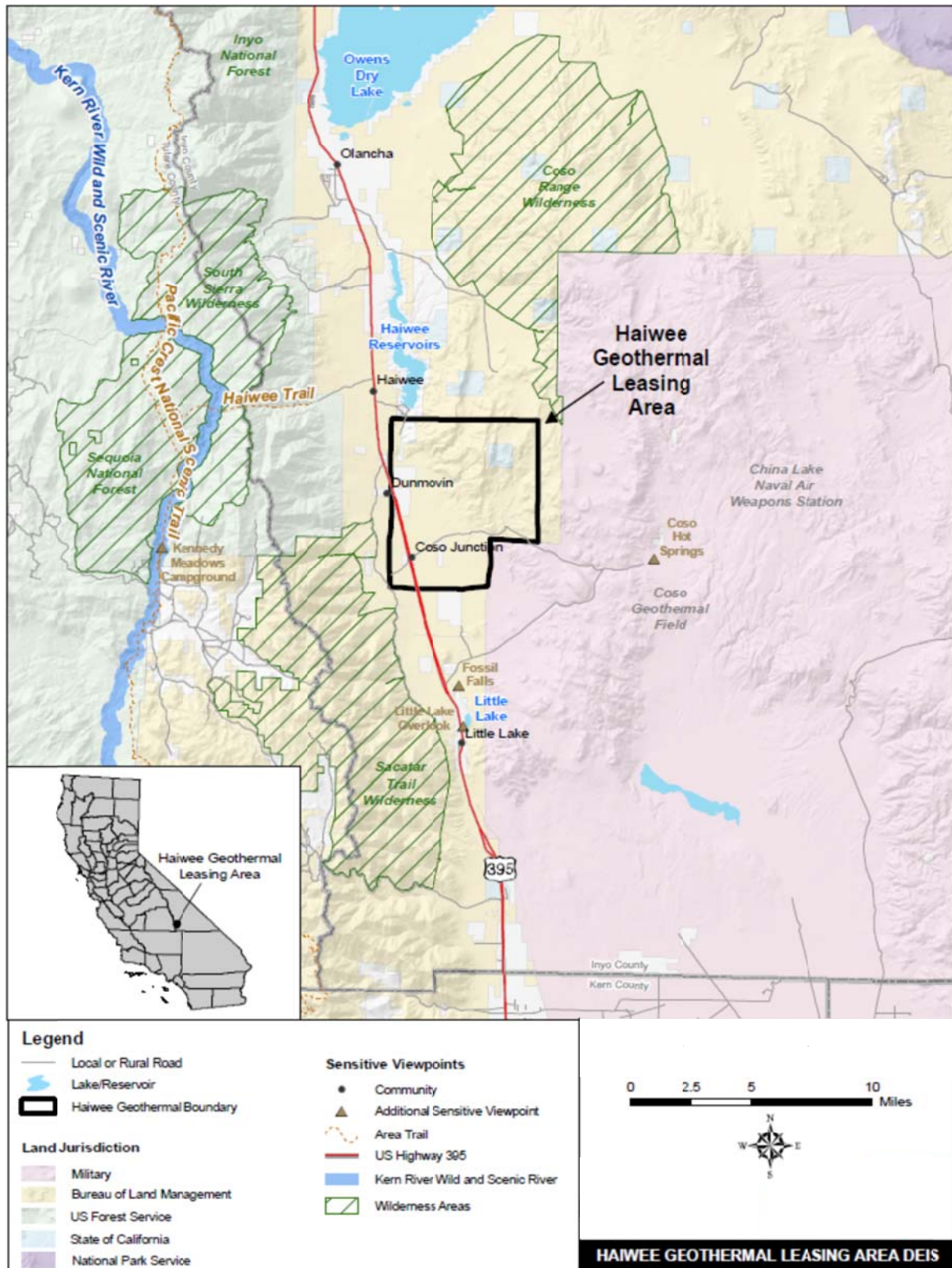
SQRU 04

Located just east of Rose Valley and southeast of South Haiwee Reservoir. This unit encompasses the southern portion of McCloud Flat, several north-south trending ridges and the southern portion of another small, isolated valley to the immediate west of McCloud Flat. The landscape is dominated by the shallow, confined valleys/flats, rocky hills and ridges, and prominent rock outcrops and is accessible only by off-highway vehicles. The landscape is generally composed of complex desert landforms of grass and low-growing shrubs in subdued yellows, tans, browns and greens, punctuated by numerous Joshua trees. The landscape exhibits a high level of scenic integrity with minimal evidence of cultural modification. The natural landscape offers features of substantial visual interest and scenic quality, and imparts a sense of remoteness.

Sensitive Viewpoints

Sensitive viewpoints are shown on Figure 3.10-2 and their corresponding visual sensitivity levels are listed on Table 3.10-2.

Figure 3.10-2 HGLA Sensitive View Points



Visibility and Distance Zones

Visibility of the HGLA from sensitive viewpoints was inventoried through a review of mapping of viewpoint locations and topographical mapping. Viewpoint locations were studied using aerial imagery from Google Earth to determine the extent of potential visual screening by topography. Views are described in the general terms of open, partially screened, or screened views.

Communities

Olancha

Olancha is located over 10 miles north of the HGLA, north of North Haiwee Reservoir. Background views of the HGLA including SQRUs 01 and 04 may occur from the community. Because of the considerable distance between Olancha and the HGLA, views of the higher elevation areas of SQRUs 01 and 04 would generally be open while views of the lower elevation areas may be partially screened by topography or built elements in the landscape.

Haiwee

Haiwee is located over five miles north of the HGLA, west of the North Haiwee Reservoir. Open background views of the HGLA including SQRUs 01 and 04 may occur from the community. Because of the considerable distance between Olancha and the HGLA, the higher elevation areas of SQRUs 01 and 04 would be much more visible than the low elevation areas.

Dunmovin

Dunmovin is located to the west of the HGLA. The community would have expansive, open views across SQRU 01. Views would extend across SQRUs 02, 03, and 04, extending up the southwest slopes of the low, rocky hills and ridges that make up SQRUs 03 and 04. Views of the northeast portions of these rating units would generally be blocked by topography. All potential views of the HGLA would occur in the foreground/middleground distance zone.

Coso Junction

Coso Junction is located within SQRU 01. The community would have expansive, open views across SQRU 01. Views would extend into SQRUs 02, 03, and 04, extending up the southwest slopes of the low, rocky hills and ridges that make up SQRUs 03 and 04. Potential views of the northeast portions of these rating units would generally be screened by topography. All potential views of the HGLA would occur in the foreground/middleground distance zone.

Little Lake

Little Lake is located over five miles from the south edge of the HGLA. This area would have open background views of the rocky hills and ridges of SQRUs 03 and 04. Potential views of SQRUs 01 and 02 would generally be screened by topography.

Travel Corridors**U.S. Highway 395**

The portion of US 395 within and near the HGLA is a state identified eligible scenic highway. It is not currently designated as a scenic highway but may be in the future. The highway crosses through the southeast portion of the HGLA within SQRU 01. The highway is in generally flat terrain and would have expansive, open views across SQRU 01. Views would extend into SQRUs 02, 03, and 04, extending up the southwest slopes of the low, rocky hills and ridges that make up SQRUs 03 and 04. Views of the northeast portions of these rating units would generally be screened by topography. All potential views of the HGLA would occur in the foreground/middleground distance zone.

Recreation and Preservation Viewpoints**Little Lake Overlook**

Little Lake Overlook is located over five miles south of the HGLA. The site provides views down onto Little Lake, which is one of the few remaining quality wetlands in the vicinity. It is an oasis in the desert. The overlook also offers scenic vistas of Little Lake and the Sierra Nevada Mountains. Due to the location of the overlook on a ridge above the lake, views are generally oriented out over the lake, to the northwest, west, and southwest. Views to the north are dominated by Red Hill, which is south of the HGLA. Generally open views of the HGLA would occur from the overlook with some screening from topography. All potential views of the HGLA would occur in the background distance zone.

Fossil Falls

Fossil Falls is located south of the HGLA, four miles from the south boundary. Fossil Falls is a ravine in a volcanic rock formation that has been eroded and polished into distinctive formations. Potential views of the southern portion of SQRU 01 would occur at the outer perimeter of the foreground/middleground distance zone. Potential views of the other SQRUs would occur in the background distance zone. Views north from Fossil Falls are generally dominated by Red Hill and may be partially screened by topography. The HGLA would potentially be visible from areas outside the ravine, but would not be visible for recreationists who descend into the ravine.

Sacatar Trail Wilderness

The Sacatar Trail Wilderness is located to the southwest of the HGLA. Potential foreground/middleground views of SQRU 01 would occur from the edge of the wilderness, while more distant views would potentially occur from within the wilderness. Potential views of the other SQRUs would occur in the background distance zone. Access to the wilderness from the east side is generally limited to the Sacatar Trail, thus views would generally be expected to occur from the trail.

Coso Range Wilderness

The Coso Range Wilderness is located to the northeast of the HGLA. Access to the wilderness from the west side is via US 395 and four-wheel drive routes, however motor vehicle use is prohibited within a wilderness area. Foreground/middleground views of SQRUs 03 and 04 would occur from the edge of the wilderness. Additional foreground/middleground views of all the SQRUs would occur from higher elevations within the wilderness where views over the hills and ridges of SQRUs 03 and 04 would occur.

South Sierra Wilderness

The South Sierra Wilderness is located to the west of the HGLA. Potential background views of all SQRUs may occur.

Haiwee Trail

The trailhead is located three miles from the HGLA. Potential foreground/middleground views of SQRUs 01, 03 and 04 would occur from the trailhead and from the trailhead access road. Potential views from the trail would be screened by topography.

Inyo National Forest Background Viewpoints

The Pacific Crest National Scenic Trail, Kennedy Meadows Campground, and the Kern River Wild and Scenic River are all located over seven miles from the HGLA. Potential background views from these viewpoints would be screened by topography.

Coso Hot Springs

Coso Hot Springs is located at the outer perimeter of the foreground/ middleground distance zone for SQRU 02 and in the background distance zone for the other SQRUs. Views of the HGLA would be screened by topography from the site.

Visual Resource Inventory and Visual Resource Management Classes

VRM Classes were not designated in agency management plans for the HGLA at the time this study was conducted. The Visual Resource Inventory study that preceded this report

established VRI Classes, which the BLM may establish as interim VRM Classes in this EIS/ROD.

The Visual Resource Inventory studies resulted in the identification of two Visual Resource Inventory classes within the HGLA (Clayton 2009). SQRUs 01 and 02, when combine with the respective viewpoints and visibility, were classified as VRI Class III, while SQRUs 03 and 04 when combined with the respective viewpoints and visibility were classified as VRI Class II. These two classes are adopted as interim VRM classes for the HGLA EIS pending further VRI study. Draft VRM classes are expected to be established in the Desert Renewable Energy Conservation Plan (DRECP) when it is published in 2012.

3.11 LANDS AND REALTY

3.11.1 Applicable Regulations, Plans, Policies/Management Goals

The federal, state, and local land use regulations and management plans potentially applicable to the HGLA are described below.

Federal Land Policy and Management Act (FLPMA) 1976 and Federal Regulations Pertaining to Rights-of- Way

In 1976, Congress passed the FLPMA, Public Law 94-57, 43 U.S.C. §§ 1701–1785, to direct the management of the public lands of the United States. In Section 601 of the FLPMA, Congress required the preparation of the California Desert Conservation Area (CDCA) Plan. It is the purpose of that plan to establish guidance for the management of the public lands of the California Desert by the BLM in clear accordance with the intent of Congress and the people of the United States, as expressed in the law.

Section 601 of the FLPMA requires that the BLM develop a plan to “provide for the immediate and future protection and administration of the public lands in the California Desert within the framework of a program of multiple uses and sustained yield, and the maintenance of environmental quality.”

A number of notable resources exist within the CDCA, including important mineral and energy resources. As a result, the CDCA Plan includes mapped areas that may have potential for energy resources, including geothermal resources. The HGLA is primarily located adjacent, or within, the Coso Known Geothermal Resource Area (KGRA).

The FLPMA also establishes the current federal legal framework for the issuance of rights of way (ROW) on public lands as per 43 U.S.C. §§ 1761–1771. Construction, operation, and

maintenance of electric facilities would require a BLM ROW grant. A ROW grant is an authorization to use a specific tract of public land for certain projects such as roads, pipelines, transmission lines, and communication sites. A ROW grant authorizes rights and privileges for a specific use of the land for a specific period of time. Generally, a BLM ROW is granted for a term appropriate for the life of a project. Applications for commercial geothermal energy facilities would be processed as ROW authorizations under the FLPMA, Subchapter V (43 U.S.C. §§ 1761 et seq.), and BLM regulations, Title 43 CFR Part 2800.

Pursuant to Title 43 CFR Section 1610.5-3, any ROW granted by the BLM must be consistent with the relevant Resource Management Plan(s). For a project located in the HGLA, the relevant plans are the CDCA Plan and its amendment, the West Mojave Desert (WEMO) Plan, which are discussed below.

Federal Energy Policy Act of 2005

The Federal Energy Policy Act of 2005 includes various initiatives directed at securing the nation's energy future, which include authorizing the United States Department of Energy, in collaboration with federal land management agencies, to designate corridors for energy transmission on federal lands within the 11 contiguous western states. A 1,050 foot wide designated Section 368 Corridor (18-23), runs north-south across the western portion of the HGLA.

California Desert Conservation Area Plan of 1980, as amended

Under the FLPMA, the BLM must manage the lands within its jurisdiction in compliance with a Resource Management Plan. The HGLA (including the three pending lease application sites), is managed pursuant to the CDCA Plan, as amended. The CDCA Plan serves as a guide for the management of all BLM-administered lands in three desert areas: the Mojave Desert, the Sonoran Desert, and a small portion of the Great Basin. The CDCA Plan covers 25 million acres, of which 12 million are public lands. The primary goal of the CDCA Plan is to provide overall maintenance of the land while planning for multiple uses and balancing the needs of people with the protection of the natural environment.

In June 2006, the CDCA was amended by the WEMO Plan. The HGLA is located within the area covered by the WEMO Plan. This plan covers the West Mojave Desert area of 9.3 million acres in Inyo, Kern, Los Angeles, and San Bernardino Counties. Included therein are 3.3 million acres of public lands administered by the BLM, 3.0 million acres of private lands, 102,000 acres administered by the State of California, while the balance consists of military lands administered by the Department of Defense. Within the HGLA the WEMO Plan establishes a conservation area for Mojave ground squirrel to ensure its long-term survival and protection.

The CDCA Plan organizes BLM-managed lands into one of five multiple-use classes: Controlled Use (C), Limited Use (L), Moderate Use (M), and Intensive Use (I). A fifth category of land, “Unclassified”, is for parcels that have not been classified and will be studied to determine what class they appropriately belong in. The HGLA is located on the BLM’s Multiple Use Class (MUC) “Class L”. MUC Class L lands protect sensitive, natural, scenic, ecological, and cultural resource values. Lands within the CDCA, including the WEMO area that is designated as MUC Class L are “managed to provide for generally lower-intensity, carefully controlled multiple use of resources, while ensuring that sensitive values are not significantly diminished.” However, it is important to note that, for MUC Class L lands, geothermal electrical generation facilities may be allowed pursuant to licenses issued under 43 CFR Section 3250, et seq., as long as all applicable NEPA requirements are met.

Nearly the entire range of the Mojave ground squirrel, a state-listed threatened species, lies within the West Mojave planning area, and most of this land is public land managed by the BLM. A total of 1,726,712 acres is included within the MGSCA. Public lands within the MGSCA are designated as a BLM Wildlife Habitat Management Area in the CDCA Plan. Within the MGSCA, the public lands south of Owens Lake are designated as MUC Class L. As further discussed in Section 3.7, Biological Resources, development is only allowed within one percent of public lands in the MGSCA consistent with the applicable WEMO Plan restrictions; according to the BLM, a total of 10,387 acres are available for development within this area (BLM 2009b, personal communication).

The CDCA Plan designated sixteen (16) major Energy Production and Utility Corridors. These corridors are available to consolidate compatible ROW, avoid sensitive resources wherever possible, complete the delivery-systems network, site ongoing projects for which decisions have been made, and for ROW networks for power needs and alternative fuel resources. The CDCA Plan also allows for the designation of corridors that address the following types of utility facilities: New electrical transmission towers and cables of 161 kV or above; all pipelines with diameters greater than 12 inches and coaxial cables for interstate communications; and major aqueducts or canals for inter-basin transfers. The plan calls for these corridors to be designed to provide a two mile standard for separation of existing facilities, and to accommodate flexibility in the selection of alternative routes for ROW.

In 1984, the CDCA Plan was amended to establish a one mile wide, five mile long corridor to connect the Coso KGRA with designated Utility Corridor A (CDCA Plan, Map 16), which runs north and south along existing power lines on the east side and adjacent to US 395. A 115 kV transmission line and a buried telephone cable line ROW (BLM California Serial Numbers CACA 13510 and CACA 18885) primarily follow the amended corridor. This

ROW was previously authorized to the California Energy Company, and then subsequently assigned to Coso Power Developers, Coso Finance Partners, and Coso Energy Developers.

The CDCA Plan also includes a geology-energy-mineral (G-E-M) resource element, which defines the following goals for G-E-M resources:

- Within the multiple-use management framework, assure the availability of known mineral resource lands for exploration and development.
- Encourage the development of mineral resources in a manner which satisfies national and local needs, and provides for economically and environmentally sound exploration, extraction, and reclamation processes.
- Develop a mineral resource inventory, G-E-M database, and professional, technical, and managerial staff knowledgeable in mineral exploration and development.

Specific objectives of the G-E-M element are:

- To continue to recognize ways of access and opportunities for exploration and development on public lands assessed to have potential for critical mineral resources, minerals of national defense importance, minerals of which the United States imports 50 percent or more, and minerals of which the United States is a net exporter.
- To continue to recognize ways of access and opportunities for exploration and development on public lands assessed to have potential for energy mineral resources. These are geothermal, oil, gas, uranium, and thorium, considered to be paramount priorities both nationally and within the State of California.

Applicable State Regulations

California State Planning and Zoning Law

The California Government Code Sections 65352, 65940, and 65944, also referred to, in part, as the State Planning and Zoning Law, includes the provisions of Senate Bill (SB) 1462, adopted in 2004, that require the military to be notified of any land use proposal located within 1,000 feet of a military installation, within special use airspace, or beneath a low level flight path. To aid in the implementation of SB 1462, the California Office of Planning and Research has drafted the R-2508 Joint Land Use Study to address land use issues for the R-2508 military range complex (R-2508 Complex). A Joint Land Use Study is a collaborative planning effort between active military installations, surrounding counties and cities, and other affected agencies. The R-2508 represents the largest block of restricted airspace in the United States. This 20,000 square-mile range complex encompasses large portions of Inyo,

Kern, San Bernardino, and Tulare Counties, and includes Edwards Air Force Base, China Lake NAWS, and the Army's Fort Irwin National Training Center.

The eastern portion of the HGLA is located within restricted area R-2505, a designated sub-area within R-2508; as such, it is considered "special use airspace". This designation requires that an evaluation of land use compatibility be conducted pursuant to sections 65352, 65940, and 65944 of the California Government Code which include the provision for consultation among the project applicant, public agencies, and the affected military branch. The Joint Land Use Study for the R-2508 complex was published May 2008, and contains a number of policies affecting land use decisions for projects within the R-2508 complex. Specifically, the R-2508 Joint Land Use Study promotes compatible land development in areas subject to aircraft noise and accident potential by providing compatible use guidelines for land areas surrounding the installation.

The R-2508 Joint Land Use Study recommends that the BLM refer specific BLM development applications to the appropriate military installation for review, and to ensure early notification of such military installations and local communities when the initial application is revised.

California State Lands Commission

A section of "school land" is located at Township 21 South, Range 38E, Section 16 within the HGLA. School lands fall under the jurisdiction of the California State Lands Commission (CSLC). Pursuant to Public Resources Code Section 6217.5, all net revenues derived from the use of school lands (for example, royalties, rents, and interest generated from mineral leasing or geothermal development) are deposited into the State Treasury to the credit of the Teachers' Retirement Fund.

Applicable Local Regulations

Inyo County

Lands under private ownership exist within and adjacent to the HGLA. Applicable management plans and policies for these lands include the Inyo County General Plan (Inyo County 2001) and Inyo County zoning regulations. Geothermal energy development is addressed in two of the Plan's elements, Government Element³ and Conservation/Open Space Element. The County's land jurisdiction also includes private projects on federal lands. *Inyo County Code Chapter 19 (Geothermal Resource Development)* regulates geothermal resource development, including exploratory wells and production projects, through a Conditional Use Permit (CUP) process and includes detailed standards regarding setbacks, noise, site restoration, etc. *Inyo County Code Section 18.77 (Water Transfers)* regulates

³The County is updating its General Plan Government Element, the draft of which includes goals and policies related to renewable energy development. The draft updated Element includes, amongst others, goals to support renewable energy development and consider, account for, and mitigate ecological, cultural, economic, and social impacts, as well as benefits, from development of such resources.

water transfers between basins in the County, as well as out of the County, through a CUP process. It also requires findings that the water transfer will not unreasonably affect the overall environment or economy of the County. The County would also assess increased property valuation due to improvements that may result from leases.

Air Installation Compatible Use Zones

The purpose of the Air Installation Compatible Use Zone (AICUZ) Program (Title 32 Part 256) is to protect the public health, safety and welfare from noise and aviation hazards through compatible development in an airport environment. The Program was instituted by the Department of Defense in 1973 to address land development surrounding military air installations, and to identify and develop a plan for land areas whose development could be significantly influenced by the operation of an airfield. As such, the AICUZ program is used to assist local communities in their future planning and zoning activities. The program addresses safety concerns within the approach and departure corridors from an airfield. The China Lake AICUZ study was approved in 1977, and an updated interim China Lake AICUZ study was released in 2007.

The China Lake NAWS maintains operational flight capabilities at Armitage Airfield. The China Lake AICUZ study analyzed baseline and prospective flight operations, and evaluated the noise and safety considerations associated with those operations. Based on this analysis, an “AICUZ footprint” and a “Military Influence Area” were created for Armitage Airfield, and the land use compatibility within these areas was evaluated. The AICUZ Program also identified Accident Potential Zones, which are areas where potential aircraft-related hazards are most likely to occur. In addition, the AICUZ study addressed lighting issues (direct or reflected) that could impair pilot vision; towers, other tall structures, and vegetation that either penetrate navigable airspace or are planned for construction near the airfield; land uses that would generate smoke, steam, or dust; land management that would attract birds, especially waterfowl; and electromagnetic interference with aircraft communications, navigation, or other electrical systems.

The HGLA does not fall into the China Lake NAWS’ Accident Potential Zone, AICUZ footprint, or MIA.

3.11.2 Affected Environment

The region surrounding the HGLA is sparsely settled. A number of small, unincorporated communities lie primarily along the US 395 corridor. There are only two incorporated cities in the general vicinity of the HGLA, Ridgecrest and California City, both located in Kern County to the south. Independence, the seat of Inyo County, is located 50 miles to the north of the HGLA. Other small, unincorporated communities in the vicinity include Haiwee,

Olancho, Dunmovin, and Little Lake. The small community of Coso Junction is located within the HGLA. Other land uses in the vicinity of the HGLA include the China Lake NAWS located to the east, North and South Haiwee reservoirs to the northwest, Little Lake Ranch to the south, and the existing Coso Geothermal Area to the southeast.

The China Lake NAWS facility covers 1.1 million acres of land, and was established in 1943 with the mission of supporting research, development, testing, and evaluation of weapons, as well as to provide primary training in the use of these weapons. The China Lake NAWS consists of two major land areas: the North Range, encompassing 950 square miles (606,926 acres), and the South Range, encompassing 760 square miles (503,510 acres). The installation currently conducts research, development, testing, and evaluation of weapons.

Although the nearby eastern Sierra Nevada, Inyo National Forest, and three designated wilderness areas provide numerous recreational opportunities, recreational use of the HGLA is more limited. National Forest System lands or designated wilderness areas are not located on or adjacent to the HGLA.

US 395, a primarily north to south trending highway that provides the principal access to the action area, traverses the Rose Valley and crosses the southwestern portion of the HGLA. The highway is a major arterial, heavily utilized for travel between Southern California, the mountain recreation areas, and northern Nevada. The remaining road network consists of a few secondary roads and numerous unpaved cross-country routes. The HGLA is generally comprised of undeveloped desert with naturally-vegetated areas.

3.11.2.1 Land Status and Jurisdiction

Lands within the HGLA are composed of federal, state, and private lands encompassing 38 sections, or 24,320 acres. The BLM public lands within the HGLA fall under the jurisdiction of the BLM's Ridgecrest Field Office in Ridgecrest, California. The HGLA encompasses 22,460 acres of BLM-managed public lands as well as three pending lease applications covering 4,460 acres. The BLM-managed lands considered for leasing are located in the Mount Diablo Meridian, and generally occupy all or portions of the following 37 sections (see Appendix I):

Township 21 South, Range 37 East, Sections 11-14, 23-26, 35-36
Township 21 South, Range 38 East, Sections 7-10, 15, 17-22, 27-34
Township 22 South, Range 37 East, Sections 1-2, 11-12
Township 22 South, Range 38 East, Sections 5-8

The three pending noncompetitive lease applications (CACA 43993, CACA 43998 and CACA 44082) total 4,460 acres, and are generally located on all or portions of the following eight sections:

CACA 43993 - Township 21 South, Range 37 East, Sections 13, 23 S 1/2, 24, 25, 26 E 1/2 of E 1/2

CACA 43998 - Township 21 South, Range 37 East, Sections 11-12

CACA 44082 - Township 21 South, Range 37 East, Section 14

The remainder of the HGLA consists of lands owned by the State of California, and private lands. State School Land managed by the California State Lands Commission (CSLC) (Section 16) is situated in the northeast portion of the HGLA. Other state-owned lands include those under the jurisdiction of Caltrans along US 395. Privately-owned lands generally occur along or near the US 395 corridor.

3.11.2.2 Land Use Authorizations

Land use authorizations include various authorizations and agreements to use BLM-administered land such as ROW grants, road use agreements, and associated temporary use permits. Land use authorizations are issued for a variety of uses, both short and long term. Short-term uses include agricultural leases, military training areas, and other uses involving minimal land improvements or disturbances. Long-term uses include ROW grants for power lines, highways, roads, pipelines, fiber optic cables, communication and electric power generation sites, and irrigation.

As previously discussed, US 395 is a major north-south route that traces the eastern slope of the Sierra Nevada, and traverses the southwestern portion of the HGLA. Much of US 395 in Inyo County is a two lane highway, but increasing traffic demands have resulted in expansion of US 395 to four lanes to the north and south of the HGLA. Other facilities in the area include the Los Angeles Aqueducts located to the west of the HGLA.

One major utility ROW presently traverses a portion of the HGLA. This corridor runs in a northwest to southeast direction in the vicinity of US 395. This corridor currently contains two LADWP transmission lines (500 kV DC and 230 kV), one Southern California Edison (SCE) 138 kV transmission line, and buried fiber optic networks and telephone lines.

Finally, a 1,050 foot wide Section 368 Designated Energy Corridor (18-23), authorized under the Federal Agency Policy Act of 2005, runs north-south across the western portion of the HGLA.

Table 3.11-1 Current Land Use Authorizations within the HGLA.

Holder	Serial #	Description
Coso Energy Developers	CACA 13510	Power Transmission Line – 50 ft
Coso Energy Developers	CACA 18885	Telephone Line – 10 ft
Southern California Edison	CACA 21596	115 kV Power Transmission Line – 80 ft
Southern California Edison	CACA 26242	12 kV Power Transmission Line – 10 ft
Verizon California LLC	CACA 26398	Fiber Optic Line – 10 ft
Little Lake Renewables LL	CACA 45386	Wind Energy Facility – Pending
Coso Operating Co.	CACA 46289	Pipeline
Deep Rose, LLC	CACA 47464	Water Pipeline
Maxx Management Corp	CACA 43998	Pending Geothermal Lease
Maxx Management Corp	CACA 44082	Pending Geothermal Lease
Terry K Metcalf	CACA 43993	Pending Geothermal Lease
CA Dept of Public Works	CALA 0 88333	Material Sites
LADWP	CALA 0 88876	500 kV Power Transmission Line – 250 ft
CA Dept of Public Works	CALA 0 93471	Federal Highway
Verizon California Inc.	CALA 0 125334	Fiber Optic Line – Variable Widths
City of Los Angeles	CALA 0 155168	34.5 kV Power Transmission Line – 50 ft
CA Dept of Public Works	CALA 0 164238	Material Site
LADWP	CARI 231	Aqueduct – 100 ft
CA Dept of Public Works	CARI 2641	Federal Highway
Southern California Edison	CARI 2861	12 kV Power Transmission Line – 25 ft
Southern California Edison	CARI 4354	12 kV Power Transmission Line – 25 ft

3.12 PUBLIC HEALTH AND SAFETY

3.12.1 Applicable Regulations, Plans, Policies/Management Goals

The CDCA Plan does not set out specific goals for human health and safety, or management of hazardous materials. However, the BLM's stated policy is to reduce threats to public health, safety, and property. In addition, in accordance with the FLPMA, the BLM is required to comply with state standards for public health and safety. Additionally, the CDCA multiple-use classifications do not allow hazardous or non-hazardous waste disposal sites on public lands, except where landfills are suitable and permitted.

3.12.2 Affected Environment

3.12.2.1 Public Health

California has a considerable mining history and a legacy of abandoned mines. According to the National Mine Land Inventory, found on the BLM's Geocommunicator site, scattered abandoned or inactive mine openings currently exist in the HGLA. To inform the public about the potential safety hazards of abandoned and inactive mines, the BLM has produced several informational brochures about National Abandoned Mine Lands Strategic Plan, Instruction Memoranda, and Technical Resources. Precautions should be utilized around such sites. Abandoned mine hazards include open shafts and adits, open pits and quarries, high and steep walls of pits and trenches, potential presence of explosives, presence of contaminated air or gas in underground shafts, and the presence of unstable buildings or structures.

The South Haiwee Dam (CA DWR dam number 6-024), a hydraulic fill dam, could pose a hazard in the event of catastrophic failure of the dam. The County of Kern in its hazardous response plan lists Haiwee Reservoir (in Inyo County) as a flood hazard to the Kern County communities south of the HGLA. Thus, a dam breach may be a hazard to any potential geothermal development. An additional hazard would be inundation by water transporting arsenic-enriched sediments across the surface of Rose Valley. The sediments could dry on the valley floor and become wind-borne and blow in the direction of Ridgecrest. Built in 1913, South Haiwee Dam was damaged in a 1952 earthquake and improvements were made subsequently. (see http://www.michigan.gov/documents/deq/deq-p2ca-caseismicpaper_281049_7.pdf).

3.12.2.2 Hazardous Materials

The term “hazardous materials” issued by the State of California to identify a variety of substances that pose a health and safety risk to the environment, humans, vegetation and wildlife. Hazardous materials within the HGLA may consist of materials in informal dumping sites and mining-related hazardous materials. Landfills of all kinds have the potential to cause adverse environmental impacts to BLM-administered land. Chemical leachate from landfills has the potential to contaminate soil and reach surface water or groundwater. Local law enforcement is responsible for enforcing laws and regulations that prohibit illegal dumping in landfills on lands that are not managed by the BLM. The closest known landfill to the HGLA is the Lone Pine Landfill, located 32.3 miles to the north of the HGLA. The Lone Pine Landfill, a permitted solid waste disposal facility, was established in 1965 to serve the disposal needs of the residents of Lone Pine, California, and the

surrounding area. The State of California defines the landfill as a Class III disposal site, accepting only non-hazardous municipal solid waste generated within its local service area. Additionally, the State Water Quality Control Board is beginning to investigate other human infrastructure that may be exacerbating impacts of naturally occurring water-borne contaminants. Haiwee Reservoir, for example, may be creating unnatural conditions that promote the mobility of naturally occurring arsenic. In the recent past, LA Department of Power and Water has deposited arsenic-rich sediments into Haiwee Reservoir directly north of the HGLA.

Hazardous mining waste consists of mineralized waste rock, ore stockpiles, and mill tailings. Metallic minerals that occur in the rock have the potential to contaminate soil and water down gradient of the mining waste. Mill tailings may contain traces of metals as well as other chemical constituents, such as acids. Mine workings and mine dumps containing sulfide mineralization can also create acid mine drainage when exposed to oxygen and water. The California Department of Conservation abandoned mine database lists 11 abandoned mine features in the HGLA area, 4 as depicted in Map 3.11.1. This type of hazardous material may occur at abandoned mines on and adjacent to BLM-administered land; however the lack of water in the area eliminates, or minimizes the potential for acid mine drainage problems.

Although firing ranges or impact areas are not known within the HGLA, there is a low potential for unexploded ordnance on public lands as a result of years of nearby military operations. No known occurrences have been documented.

In summary, no detailed surveys of potential hazardous or solid waste sites have been undertaken within the HGLA although hazards are immediately present just outside the HGLA. The BLM maintains no records of reportable spills in this area. Although use of motorized vehicles and other equipment by the public may have resulted in periodic and scattered spills or releases of fuel and petroleum products, no such events have been documented.

3.13 ENERGY AND MINERAL RESOURCES

3.13.1 Applicable Regulations, Plans, Policies/Management Goals

Mineral resources on federal lands are governed by the General Mining Law of 1872, as amended; those portions of the FLPMA of 1976, as amended, that affect the General Mining Law; the Surface Resources Act of 1955, and the Mining and Minerals Policy Act of 1970. Oil and gas leasing on federal lands is guided by the Energy Policy Act of 2005. Geothermal

leasing is guided by the Geothermal Steam Act of 1970 (30 USC 1001 et. seq.), as amended by the Energy Policy Act of 2005.

The BLM manages oil and gas leases under Title 43, CFR Part 3100, and exploration for these resources under Part 3150. Geothermal leasing is managed under Part 3200, mineral materials under Part 3600, mining claims for locatable minerals under Part 3800, and solid leasable minerals other than coal or oil shale under Part 3500 regulations.

The most applicable management goal of the CDCA Plan addresses the G-E-M resources as follows:

- (1) Within the multiple-use management framework, assure the availability of known mineral resource lands for exploration and development.
- (2) Encourage the development of mineral resources in a manner which satisfies national and local needs and provides for economically and environmentally sound exploration, extraction, and reclamation processes.
- (3) Develop a mineral resource inventory, G-E-M database, and professional, technical, and managerial staff knowledgeable in mineral exploration and development.

3.13.2 Affected Environment

3.13.2.1 Renewable Energy Resources

Renewable energy includes solar power, wind, biomass, hydropower, and geothermal resources. These resources all have different requirements related to economic development. However, some issues are common to all, including distance to existing electric transmission facilities, and compatibility with existing federal land uses. As demand for clean and viable energy to power the nation has increased, consideration of renewable energy sources available on public lands has come to the forefront of land management planning.

The National Renewable Energy Laboratory (NREL), an agency of the Department of Energy, has developed a Renewable Resource Assessment Project. The findings of this project are contained in a 2003 report entitled *Assessing the Potential for Renewable Energy on Public Lands*. This report identified criteria that are considered in establishing potentials for various types of renewable energy. It also summarizes these potentials, and identifies the top 25 BLM Planning Areas with the highest potentials for various classes of renewable

energy development. The Ridgecrest Planning Area was included in the top 25 planning units with the highest potential for solar (photovoltaics), wind, and geothermal resources.

Areas such as Coso and Randsburg have both been identified by geothermal personnel from the BLM state office as California “top-pick” sites having the highest potential for geothermal resource development. The majority of the HGLA lies within the federally designated Coso KGRA. This KGRA contains the Coso Geothermal Project, a commercially developed geothermal field currently producing over 200 megawatts (MW) of electricity.

Currently, there are no solar energy sites on BLM-administered lands within the HGLA. However, demand for renewable energy development is expected to increase, and management actions may be necessary to provide for additional future renewable energy growth in the HGLA while protecting its sensitive resource values.

There are no permanent wind energy facilities on BLM-administered lands within the HGLA. Two wind energy ROW applications have been submitted to the BLM (CACA 45386, issued to Little Lake South Renewables, RES America Developments, Inc., and CACA 50170, issued to Debenham Energy) fall within the HGLA. Application CACA 50170 has since been withdrawn and the file is now closed. If authorized, the ROW grant for the Little Lake South Renewables, LLC – Little Lake North Project (CACA 45386), would only allow for site testing and wind energy monitoring (i.e., installation of met towers). This authorization would not give the ROW grant holders the development rights; development would still require the submittal of a separate application to the BLM for review, analysis, and separate approval. Future applications for testing and/or development would be processed in accordance with the policies and best management practices established by the *Final Programmatic Environmental Impact Statement on Wind Energy Development on BLM Administered Lands in the Western United States* (2005). The pending ROW application is generally located in the western half of the HGLA, and includes 8,835 acres (CACA 45386). (See Figure 2.1-1)

Two other geothermal-related projects (Deep Rose Geothermal Exploration Project and Coso Hay Ranch Water Extraction and Delivery System) have been proposed within the HGLA. Deep Rose, LLC (Deep Rose) of Ridgecrest, California, has proposed the construction of a well pad, access road, water line, support facilities (i.e. truck turnout areas and water storage areas), and the drilling and testing of up to four geothermal exploratory wells within the HGLA. The proposed well pad is located on land owned by the State of California, and managed by the CSLC. After the initial well, subsequent wells may or may not be drilled based on the subsurface geological investigations. The area to be explored is located near southern McCloud Flat, within Township 21 South, Range 38 East, Section 16. The access road, water line, and support facilities are located on public land administered by the BLM.

Deep Rose has submitted to the California Department of Conservation Division of Oil, Gas, and Geothermal Resources (DOGGR) a Notice of Intent (NOI) to Drill and an application for a Geothermal Resources Prospecting Permit to the CSLC. The CSLC may issue such permits under the authority of the State Geothermal Resources Act of 1967, as amended in 1978.

The Coso Operating Company, on behalf of Coso Hay Ranch LLC (“Coso”), completed the Coso Hay Ranch Water Extraction and Delivery System project in early 2010. This project encompasses a nine mile long corridor with a 50-foot ROW, encompassing approximately 54 acres. This ROW includes 5.63 acres of private land included within the Coso Hay Ranch, 32.24 acres on public lands managed by the BLM, and 16.18 acres within the China Lake NAWS. The Coso Hay Ranch project affects the following BLM lands: Township 21 South, Range 37 East, Sections 35-36 and Township 21 South, Range 38 East, Sections 31-34.

Two existing wells at Coso Hay Ranch (the North Well and South Well) are the source of the augmentation water for the Coso geothermal facilities. A 12-inch pipeline, extending from the North Well past the South Well to a pump station located adjacent to the South Well, is located entirely on the Hay Ranch. A 250,000-gallon collection tank, surrounded by a perimeter chain link fence, is located at the pump station. From this collection tank, a 20-inch pipeline has been installed along an existing access road leading to the injection site (Well 88-1) located on the Coso property.

Power for the Coso Hay Ranch Water Extraction and Delivery System project is provided by a new substation constructed by SCE at a location immediately adjacent to the project pumping equipment. The new substation is tied into SCE’s existing transmission line which runs past Hay Ranch using an overhead connection. The SCE substation is unmanned, and located entirely within the Hay Ranch property.

3.13.2.2 Energy Minerals

Oil, Gas, and Geothermal

The BLM considers geothermal resources to be a fluid mineral resource along with oil and natural gas. Therefore, while land closures or restrictions to fluid leasable minerals are primarily meant for oil and gas exploration and development, they apply to geothermal exploration and development as well.

Oil and gas drilling and development share other aspects with geothermal resources. Much of the data on geothermal resources comes from oil and gas well drilling. Also, Using oil and gas infrastructure is under consideration to enhance geothermal resources and vice versa (Western Governors’ Association 2006).

Non-Energy Minerals

Mining activities in Inyo County extract common minerals such as sand, gravel, clay, borates, pumice, and perlite. Public agencies, such as Caltrans and Inyo County, are the largest users of these minerals. The related employment contributes both to the county's economy and to local infrastructure. Future mineral price fluctuations and international political events will likely continue to affect the extent of the mining industry in Inyo County.

California Lightweight Pumice, Inc. has its existing Makayla Pumice Mine operating within and adjacent to the HGLA. The BLM disposes the pumice through mineral material sales contracts over 130 acres. This area includes portions of public land within Township 21 South, Range 38 East, Section 14, S 1/2 of SE 1/4, Section 21, approximate center (the Makayla pit, 60 acres), Section 23, N 1/2 of NE 1/4, and Section 35, S 1/2 of NE 1/4. Sampling and exploration for pumice has also been authorized in Township 21 South, Range 38 East, portions of Sections 15 and 21.

Other active mines in the area include the TXI Olancho Pumice Mine east of Haiwee Reservoir on private land, and LADWP quarry sites for stone immediately south of Haiwee Dam. A number of inactive and abandoned mineral mines are also scattered throughout the HGLA (including pumice and molybdenum) and the surrounding region.

There are 23 active mining claims recorded with the BLM within the HGLA (Table 3.14-1). An authorized material site (CACA 41832) on BLM public land (Township 21 South, Range 37 East, Section 36, SW 1/4 of SW 1/4) is situated in the HGLA. The site's products serve for maintaining US 395 along Inyo County's front range near Coso Junction. The material site is owned and operated by the California Department of Transportation.

Table 3.13-1 Active Recorded Mining Claims within the HGLA – BLM

Claim Name	Type	Date Recorded	Date of Location	Date of Latest Assessment	Serial # (Full)
MAKAYLA PUMICE NO 1	PLACER	08/21/2000	06/26/2000	8/17/2009	CAMC277668
MAKAYLA PUMICE NO 2	PLACER	08/21/2000	06/26/2000	8/17/2009	CAMC277669
MARGIE 1	PLACER	08/21/2000	06/21/2000	8/27/2009	CAMC277670
MARGIE 2	PLACER	08/21/2000	06/21/2000	8/27/2009	CAMC277671
MARGIE 5	PLACER	08/21/2000	06/21/2000	8/27/2009	CAMC277674
MARGIE 6	PLACER	08/21/2000	06/21/2000	8/27/2009	CAMC277675
MORIAH 1	PLACER	08/21/2000	06/21/2000	8/27/2009	CAMC277682
MORIAH 2	PLACER	08/21/2000	06/21/2000	8/27/2009	CAMC277683
MORIAH 3	PLACER	08/21/2000	06/21/2000	8/27/2009	CAMC277684
MORIAH 4	PLACER	08/21/2000	06/21/2000	8/27/2009	CAMC277685
MORIAH 5	PLACER	08/21/2000	06/21/2000	8/27/2009	CAMC277686
MORIAH 6	PLACER	08/21/2000	06/21/2000	8/27/2009	CAMC277687
MORIAH 7	PLACER	08/21/2000	06/21/2000	8/27/2009	CAMC277688
MORIAH 8	PLACER	08/21/2000	06/21/2000	8/27/2009	CAMC277689
MORIAH 9	PLACER	08/21/2000	06/21/2000	8/27/2009	CAMC277690
MORIAH 10	PLACER	08/21/2000	06/21/2000	8/27/2009	CAMC277691
MORIAH 11	PLACER	08/21/2000	06/21/2000	8/27/2009	CAMC277692
MORIAH 12	PLACER	08/21/2000	06/21/2000	8/27/2009	CAMC277693
MORIAH 13	PLACER	08/21/2000	06/21/2000	8/27/2009	CAMC277694
MORIAH 14	PLACER	08/21/2000	06/21/2000	8/27/2009	CAMC277695
DB 197	LODE	11/27/2007	09/08/2007	8/27/2009	CAMC291086
DB 198	LODE	11/27/2007	09/08/2007	8/27/2009	CAMC291087
DB 199	LODE	11/27/2007	09/08/2007	8/27/2009	CAMC291088

Source: BLM, <http://www.geocommunicator.gov/blmMap/Map.jsp?MAP=LAND>, Accessed on November 3, 2009.

3.14 WILD HORSES AND BURROS

3.14.1 Applicable Regulations, Plans, Policies/Management Goals

Management of wild, free-roaming horses and burros on federal lands was authorized by Congress on December 15, 1971, by the Wild Horse and Burros Act (PL 92-195; 16 U.S.C. 1331-1340) (Act), as amended, by the FLPMA of 1976 (PL 94-579) and the Public Rangelands Improvement Act of 1978 (PL 95-514). The regulations found at 43 CFR Part 4700 and Part 4700 of the BLM Manual prescribe the authorities, objectives, and policies

that guide the protection, management, control, and disposition of wild free-roaming horses and burros in accordance with the Act. Through the Act, Congress declared, “It is the policy of Congress that wild free-roaming horses and burros shall be protected from capture, branding, harassment, or death; and to accomplish this they are to be considered in the area where presently found, as an integral part of the natural system of the public lands” and are to be managed “in a thriving natural ecological balance”. The policy of the BLM is to manage wild horses and burros in a manner that will insure healthy herds for future generations of Americans, and contribute to the diversity of life forms on public lands administered by the BLM. The Act does not apply to lands managed by the Department of Defense or the National Park Service (although such management is not prohibited on those lands).

The areas where wild horses and burros were known to exist in the California Desert District at the time of the passage of the Wild Horse and Burro Act are addressed in the CDCA Plan (1980, as amended; cuff., Wild Horse and Burro Management Area, Map No. 8). To the extent that wild horses and burros roam outside a Herd Management Area, they are considered a nuisance and can be removed from the non-Herd Management Area areas. It is the policy of the BLM to manage and remove excess and nuisance animals through humane, live capture means and place them in private maintenance through the BLM’s Adopt-a-Horse/Burro program. The following three actions have impacted the management for the Herd Management Area in the greater HGLA region:

- The 1981 Amendment 24 to the CDCA plan deleted the Centennial Herd Management Area for burros, because of the conflicts that they were imposing on the China Lake NAWS.
- The 1994 California Desert Protection Act, Public Law 103-433-October 31, 1994, Section 805(g)(4) assigned the Secretary of Navy responsibility for the management of wild horses and burros located on the China Lake NAWS lands. This is 80 percent of the Centennial Herd Management Area where the majority of the horses’ home range is located. The remaining 20 percent of the Herd Management Area is on BLM lands.
- The 2005 NAWS/China Lake Wild Horse and Burro Management Plan identified the goals and objectives for these animals residing within the China Lake Naval Air Weapons Station. It identified that it will retain the Herd Management Area for horses at an Appropriate Management Level of 168 animals and would continue to implement the total removal of burros from their Navy administered lands. The Centennial Herd Management Area acreage is 71,353 acres BLM and 247,147 acres Navy.

The CDCA Plan's Wild Horse and Burro Element lists the following applicable goals:

- Provide for the year-long food requirements of wild horses and burros by reserving sufficient forage to meet the biological requirements of a specified number of animals.
- Provide adequate cover for wild horses and burros by maintaining free access to existing cover for these animals. Attainment of this objective would be consistent with the need to restrict wild horse and burro use from selected riparian areas, when required to protect other resource values.
- Provide adequate water to meet the year-long requirements of wild horses and burros by improving existing waters, developing new waters, and developing alternative waters when wild horses and burros must be excluded from an existing water.
- Provide adequate living space for wild horses and burros by designing new structures or modifying existing structures in such a manner as to allow for the normal distribution and movement patterns of these animals. The key to attainment of this objective is preservation of the home ranges established by a majority of wild horses and burros by use of individual Herd Management Areas. Attainment of this objective would be consistent with the need to restrict wild horse and burro access in selected areas in order to protect other resource values, and specifically to manage burros so that they do not jeopardize the continued existence and welfare of bighorn sheep.
- Protect wild horses and burros on public lands by conducting surveillance to prevent unauthorized removal or undue harassment of the animals.

3.14.2 Affected Environment

Portions of the Centennial Herd Area and the Herd Management Area are located within the HGLA. The CDCA Plan identifies the Centennial Herd Area and Herd Management Area, and establishes the appropriate management level for 168 wild horses and 1,137 burros.

A 2008 aerial census counted 254 horses. The aerial survey showed that 95 percent of the horses occurred within the Navy administered lands, with the majority found on the western half of the Herd Management Area.

The aerial census data also indicated there are 55-60 head of horses utilizing lands along the boundary of the Navy and BLM lands which would have the potential to be within the existing Lacy-Cactus-McCloud (L-C-M) Allotment any time throughout the year. No burros

were sighted in the proximity of the L-C-M Allotment. The level of use by the wild horse population within the current L-C-M Allotment is very low. It is suspected the lack of water and past drought conditions in the area has not been conducive for the wild horses to inhabit this area.

3.15 GRAZING

3.15.1 Applicable Regulations, Plans, Policies/Management Goals

Rangeland management on BLM lands is carried out under a number of laws and regulations. The primary management authority is the Taylor Grazing Act (TGA) of 1934, as amended and supplemented. Additional laws includes the FLPMA of 1976 and the Public Rangelands Improvement Act of 1978. The regulations in 43 CFR 4100 address grazing administration. Among the important provisions of the regulations is the requirement to provide a two year notification when public lands within a grazing allotment are devoted to a public purpose which precludes livestock grazing (43 CFR 4110.4-2 (b)). Under these provisions, a permittee cannot lose any of their grazing preference for two years from the “date of notification” that lands in the allotment would be dedicated to another uses. The permittee may waive the two year notification if they choose.

The CDCA Plan Classifies the project area as suitable for continued grazing and provides a number of stipulations to manage livestock grazing.

3.15.2 Affected Environment

Livestock grazing has occurred for many years in the HGLA. There are currently two separate livestock grazing allotments in the HGLA. These are the 41,852 acre L-C-M and the 51,729 acre Tunawee livestock grazing allotments. Grazing on the L-C-M Allotment has not occurred during the past nine years due to administrative issues and is currently undergoing the grazing permit renewal process. The Tunawee Allotment is classified as suitable for both sheep and cattle grazing. Sheep have grazed the allotment regularly over the last ten years. Rangeland health inventories found that both allotments met Rangeland Health standards

3.16 RECREATION

3.16.1 Applicable Regulations, Plans, Policies/Management Goals

The CDCA Plan's Recreation Element lists the following goals:

- Provide a wide range of opportunities within resource capabilities for engaging in recreational activities for all desert users.
- Provide recreational management and facilities consistent with sound visitor and resource protection practices, with emphasis on conserving desert resources that have special scenic, historic, scientific, or recreational values.
- Protect desert users and minimize conflicts among recreationists and users of other desert resources.
- Enhance the enjoyment of the recreation experience and aid resource protection by increasing understanding and knowledge of the California Desert's resources and uses. Pursue this goal through public involvement in volunteer efforts, interpretation and environmental education programs, community outreach efforts, and other programs.
- Monitor and evaluate visitor use and preferences, and adjust BLM programs to meet changing needs where appropriate.
- Provide for off-road-vehicle recreation use where appropriate in conformance with FLPMA, Section 601, and Executive Orders 11644 and 11989.

3.16.2 Affected Environment

The Rose Valley and Owens Valley provides numerous recreational opportunities. Most of the land is owned and administered by the U.S. Department of Agriculture, Forest Service (USFS), the BLM, and the City of Los Angeles. Although much of the Owens Valley floor is comprised of LADWP land, about 75% of LADWP-owned land in Inyo is also open to the public for daytime recreational uses.

The BLM's Ridgecrest Field Office alone manages nearly 1.9 million acres of public lands in Kern, Inyo, Mono, Los Angeles, and San Bernardino counties. These public lands hosted more than 900,000 visitors in fiscal year 2008, providing a variety of recreation opportunities that include motorized OHV trail riding for all-terrain vehicles and non-motorized activities such as hiking, backpacking, hang gliding, hunting, rock hounding, horseback riding, wildlife viewing, photography, rock climbing and mountain biking.

Recreational opportunities within the Inyo National Forest, located to the west of the HGLA, include similar activities. In addition, two ski resorts offer alpine skiing and snowboarding;

over 100 miles of trails groomed for multiple purpose winter use (snowmobile, skiing, and hiking), and 45 miles of trails groomed for cross-country skiing.

3.16.3 Existing Conditions

The HGLA and immediate surrounding area support most of the above-listed recreational activities. In addition, the Haiwee Deer Winter Range Watchable Wildlife site offers opportunities to view a portion of the East Monache mule deer herd. The BLM, Kerncrest Audubon, and the Bristlecone Chapter of the California Native Plant Society have also developed a public area on the southeastern side of Little Lake known as the “Little Lake Interpretive Site”. This site provides scenic views of the lake, wildlife, wetlands and the Sierra Nevada Range. Interpretive panels provide information on birds, geology, and archaeological history of the area. A variety of native plants, notably wetland species, also occur around Little Lake. The surrounding private Little Lake Ranch consists of approximately 1,200 acres, and is managed to provide wildlife habitat and wildlife-oriented recreation, including hunting, fishing, and wildlife viewing.

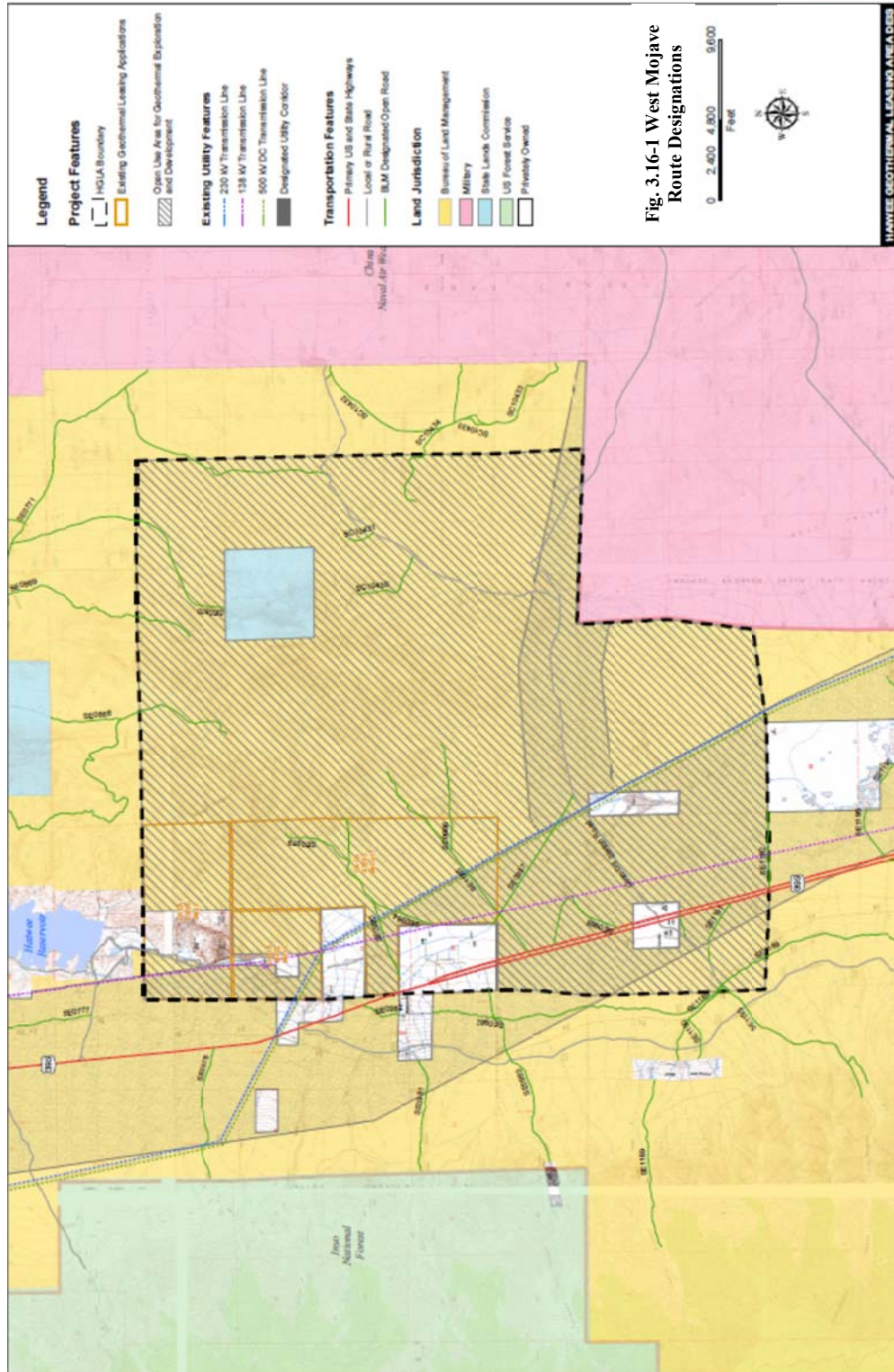
The BLM limits OHV use in the HGLA to designated routes of travel. Such routes are identified as “open” through the BLM planning process. Closed routes are signed on the ground, and off-road travel is prohibited unless prior approval has been granted by an authorized officer. Presently, motorized-vehicle access on BLM lands within the HGLA occurs on “routes of travel” in accordance with the Multiple-Use Class L. In Multiple-Use Class L, only those routes of travel that are specifically “approved” may be used by motor vehicles. According to the West Mojave Route Designation Program, the following existing BLM routes within the HGLA are designated as “open”: SC1043O, SC10431, SC10434, SE1085, SE1189, SE1191, SE1192, SEO771, SEO866, SEO869, SEO870, SEO980, SEO984, SEO979, SEO986, SEO987, and SEO988 (Figure 3.17-1). These routes currently provide for motorized-vehicle access for recreation activities (including OHV use) and other uses such as utility corridors, livestock operations, active mineral extraction/exploration sites, and private lands.

Public lands are allocated as Special Recreation Management Areas (SRMA) or as Extensive Recreation Management Areas (ERMA). A SRMA is a unit where specific recreation/tourism interests have expressed a desire for certain kind of activities, experiences, and other benefits. As such, these units are managed intensively for recreation, and the setting character in these units is a high priority. Areas with a SRMA allocation typically see investments in recreation facilities and visitor services. An ERMA is a unit with no identifiable market demand for structured recreation opportunities. Rather, an ERMA emphasizes the traditional dispersed recreation use of public lands. ERMA's are managed custodially; resources committed are generally limited and include provisions for visitor

health and safety, and those aimed at reducing damage and mitigating user conflict. Visitors who want to avoid areas of intensive recreation activities generally prefer ERMA. By default, anything not allocated as a SRMA becomes part of an ERMA.

A SRMA may be further divided in to Recreation Management Zones to provide for micro-planning in zones that have differing characteristics or management needs within an SRMA. Per the BLM planning process, Recreation Opportunity Spectrum classifications are used to help set recreation themes within management areas. The HGLA occurs within the “Roaded Natural” category. This designation is given to areas typically characterized by a natural environment with moderate evidence of humans.

Figure 3.16-1 West Mojave Route Designation Program Map



The BLM does not have visitation statistics specific to the HGLA; however, the recreational uses and visitation rates to the Ridgecrest SRMA between October 1, 2008 and September 30, 2009 are available, and are summarized in Table 3.17-1. Total estimated visitation (visits and visitor days) between October 1, 2008 and September 30, 2009, for the Ridgecrest SRMA was 235,636 and 140,090, respectively. The most common activities within the Ridgecrest SRMA included driving for pleasure, OHV trail riding, horseback riding, camping, hiking, and mountain bicycling.

Table 3.16-1 Ridgecrest Special Recreation Management Area: Recreational Use and Visitation

Activity	Number of Participants	Visitor
Site: Dispersed-Ridgecrest, ID: 00000.000		
Bicycling - Mountain	4,603	767
Camping	2,638	4,827
Driving for Pleasure	16,397	4,177
Hiking/Walking/Running	6,905	1,151
Horseback Riding	4,806	915
Hunting – Upland Bird	3,452	1,151
Nature Study	3,452	575
OHV - ATV	2,302	575
OHV – Cars/Trucks/SUVs	16,340	2,838
OHV - Motorcycle	6,935	1,155
Photography	3,452	288
Racing – Horse Endurance	272	327
Rockhounding/Mineral Collection	2,302	575
Target Practice	2,302	384
Viewing - Wildlife	2,302	767

Source: BLM 2009.

BLM also manages competitive recreational events, recreation-related commercial enterprises, and other organized events through the use of Special Recreation Permits. Special Recreation Permits are authorizations which allow specified recreational uses of the public lands and related waters. They are issued as a means to manage visitor use, protect natural and cultural resources, and provide a mechanism to accommodate commercial recreational uses. Special Recreation Permits within the HGLA includes permits issued for equestrian endurance rides and dual sport motorcycle tours.

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recreational uses. Special Recreation Permits within the HGLA include permits issued for equestrian endurance rides and dual sport motorcycle tours.

3.17 SPECIAL DESIGNATIONS

3.17.1 Applicable Regulations, Plans, Policies/Management Goals

Special area designations on public lands can be established by Congress, Presidential Proclamation, or under BLM administrative procedures. The BLM then has the authority to adopt special management designations through RMP amendments or revisions. At its discretion, the BLM may also apply administrative designations in areas requiring special management. Administrative designations are not legislative. Special areas that are designated administratively by the BLM include ACEC, Research Natural Areas, National Natural Landmarks, Backcountry Byways, and Watchable Wildlife Areas. Uses are permitted in the administratively designated areas to the extent that the uses are in harmony with the purpose for which the area was designated.

National Wilderness Areas, designated by Congress, are defined by the Wilderness Act of 1964 as places “where the earth and its community of life are untrammelled by man, where man himself is a visitor who does not remain.” Designation is aimed at ensuring that these lands are preserved and protected in their natural condition. Wilderness areas, which are generally 5,000 acres or more, offer outstanding opportunities for solitude or a primitive and unconfined type of recreation; such areas may also contain ecological, geological, or other features that have scientific, scenic, or historical value.

The BLM manages designated wilderness consistent with the California Desert Protection Act (CDPA) of 1994, the administrative instruments (regulations, policies, etc.) from that statute, and other applicable federal statutes. These instruments identified management direction for these lands with respect to specific uses that may occur within wilderness, as well as overall goals for lands designated. Of particular importance is the clear Congressional intent that wilderness designations not lead to the creation of “buffer zones” around wilderness boundaries. In and of themselves, non-wilderness activities visible or audible from wilderness are not to be precluded up to such boundaries.

The ACEC designation is an administrative designation unique to the BLM. The BLM uses the ACEC designation to highlight public land areas where special management attention is necessary to protect and prevent irreparable damage to important historical, cultural, and scenic values; fish or wildlife resources; or other natural systems or processes. The ACEC designation may also be used to protect human life and safety from natural hazards.

The FLPMA states that the BLM will give priority to the designation and protection of ACECs in the development and revision of land use plans. The ACEC designation indicates to the public that the BLM recognizes that an area has significant values and has established special management measures to protect those values. In addition, an ACEC designation also serves as a reminder that significant value(s) or resource(s) exist that must be accommodated when future management actions and land use proposals are considered within an ACEC or its vicinity. These ACECs differ from other special management designations in that designation by itself does not automatically prohibit or restrict other uses in the area. The one exception is that a mining plan of operation is required for any proposed mining activity within a designated ACEC.

The CDCA Plan does not provide specific management goals or guidelines addressing Special Designation Areas.

3.17.2 Affected Environment

A number of special areas within and near the HGLA have been designated under the above guidelines to protect unique characteristics and contain resources that have been identified as scientifically, educationally, or recreationally important. Such areas include one wilderness area and one ACEC. Special management is administered to these areas with the intent to improve the manageability of the areas, allowing the BLM to preserve, protect, and evaluate these significant components of national heritage.

3.17.3 Existing Conditions

No designated wilderness areas are situated within the HGLA. However, the Coso Range Wilderness Area, administered by the BLM, is located approximately one mile northeast of the HGLA, and comprises 49,294 acres of land designated for camping, hiking, backpacking, and horseback riding. The Coso Range Wilderness encompasses the northern section of the Coso Mountain Range, an area of extensive erosion revealing volcanic displays and numerous valleys and washes. Vermilion Canyon, located in the western side of the wilderness, and Joshua Flat are two especially important areas within this wilderness. The Sacatar Trails Wilderness is also in the vicinity of the HGLA, beginning about a mile to the southwest. It contains about 51,900 acres and spans elevations from about 3,500-8,800 feet above sea level. This wilderness is part of the southern Sierra Nevada Mountains and is on the eastern slope.

One designated ACEC, the Rose Spring ACEC, is located within the HGLA. The designation of the ACEC was made in recognition of important and irreplaceable cultural resources, and the need to protect those resources. The Rose Spring ACEC, designated by the CDCA Plan,

consists of 859 acres. A management plan was prepared in 1985. It recommended closure of the ACEC to motorized vehicles.

3.18 TRAFFIC / TRANSPORTATION

3.18.1 Applicable Regulations, Plans, Policies/Management Goals

The CDCA Plan's Motorized Vehicle Access Element seeks to manage motorized vehicle access on public lands, and designate areas for appropriate vehicle access. To these ends, the CDCA Plan seeks to constrain access to balance public and private needs, to avoid adverse impacts to desert resources, and to use maps, signs, and published information to alert users to motorized vehicle access situations (CDCA Plan, 1980, as amended).

The CDCA Plan also establishes five multiple-use classes that govern land use activities in the CDCA including controlled (C), limited (L), moderate (M), intensive (I), and Unclassified (U) uses. The CDCA Plan prohibits motorized vehicle access to lands in Multiple-Use Class C, which includes wilderness areas designated by Congress. Operations occurring on Class C lands are entirely dependent upon whether the proponent can prove that they possess existing rights that pre-date the declaration of the areas as wilderness or other restricted use areas.

The CDCA Plan allows access for mineral exploration and development, but indicates that travel corridors might be subject to closure or limitation in Multiple-Use classes L, M, and I. Multiple-Use Class L allows new roads to be developed pursuant to approved plans. Multiple-Use classes M and I allow new routes to be developed upon the authorized officer's approval (CDCA Plan, 1980, as amended). The HGLA is classified as multiple-use class L.

3.18.2 Affected Environment

This section describes the existing transportation and traffic conditions in Inyo County in and around the HGLA. Inyo County, the second largest county in California, is centrally located in the eastern part of the state. Ninety-eight percent of the lands within the County are owned by public agencies. The City of Bishop is the only incorporated city in the county. Given the rural nature of the communities, low development densities, and limited options for using alternate modes of travel, transportation in Inyo County is primarily by automobile. No passenger or freight rail service currently exists in the county, and air travel is limited.

Inyo County's road network is comprised of 3,520 miles of streets, roads, and highways (Inyo County 2009). The system is built around a framework of state and federal highways

including US 395, US 6, State Road (SR) 127, SR 136, SR 168, SR 178, and SR 190, and Coso-Gill Station and Sykes Roads, two county roads. Other than US 395, SR 190 is the highway closest to the HGLA, merging with US 395 in Olancho approximately 11 miles north of the HGLA. Coso-Gill Station Road traverses the entire southern portion of HGLA. No other federal or state highways, or numbered County roads, are located in the vicinity of the HGLA (Figure 3.19-1).

US 395, the major north-south corridor that traverses Inyo County, is designated as a Rural Principal Arterial, is part of the National Highway System, and is included in the Subsystem of Highways for the Movement of Extra Legal Permit Loads systems (Inyo County 2009). It is a federal Surface Transportation Assistance Act route, authorized for use by larger trucks. Approximately 95 percent of the traffic on US 395 within Inyo County originates from outside the county, indicating that US 395 serves a significant amount of interstate and interregional travel.

As a result of its rural setting and lack of a diverse system of roads and highways in the vicinity of the HGLA, the scope of the following analysis is limited primarily to US 395 and, to a lesser degree, to SR 190.

3.18.3 Existing Conditions

3.18.3.1 Existing Access

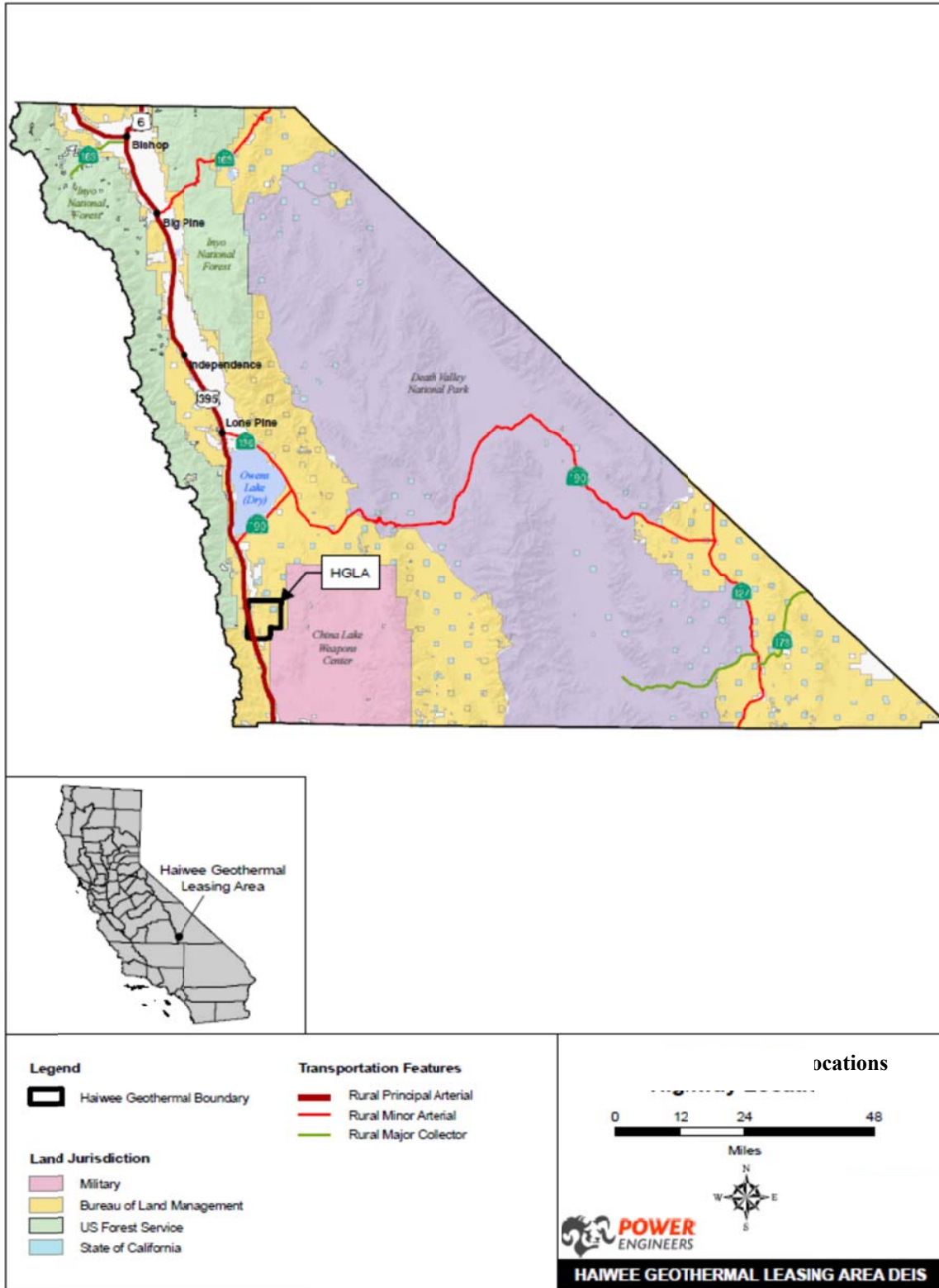
US 395 is the only highway providing access to the HGLA. Running in a generally north to south direction, US 395 crosses the southwestern portion of the HGLA (Figure 3.19-1). US 395 in Inyo County is generally a four-lane highway. A review of the Regional Transportation Plan's list of Short Range Projects (5-10 years) for US 395 indicates that segments from Olancho north, and from the Inyo-Kern County line south, are scheduled for four-lining (Inyo County 2009). However, future expansion plans for US 395 in the vicinity of the HGLA between Dunsmuir and south of Coso Junction, are currently unknown. Although US 395 is an eligible State Scenic Highway in the vicinity of the HGLA, it has not been designated as such (CA DOT 2009).

SR 190 is the only other highway located relatively close to the HGLA (Figure 3.19-1). SR 190 terminates at US 395 in Olancho. Two un-numbered county roads provide the principal access to interior portions of the HGLA from US 395 in Coso Junction. Coso-Gill Station Road extends east from US 395 to provide access to the south-central portion of the HGLA; Sykes Road extends southwest from US 395, and provides access to the southwestern-most portion of the HGLA.

3.18.3.2 Existing Traffic Volumes

Roadway operations are measured in terms of level of service (LOS). LOS is a qualitative measure describing operational conditions within a traffic stream based on service measures such as speed and travel time, freedom to maneuver, traffic interruptions, comfort, and convenience. LOS is defined for each type of facility that has analysis procedures available in the Highway Capacity Manual 2000. Letters designate each LOS from A to F, with LOS A representing the best operating conditions and LOS F representing the worst. In addition, the Highway Capacity Manual further categorizes two-lane highways as either Class I or Class II. Class I facilities are two-lane highways with relatively high speeds and that are major inter-city routes, primary arterials connecting major traffic generators, daily commuter routes, or primary links in state or national highway networks. They often serve long-distance trips or provide connecting links between facilities that serve long-distance trips. Two-lane sections of US 395 in Inyo County are considered Class I (Inyo County 2009).

Figure 3.18-1 Highway Locations



The historic daily traffic volumes in the vicinity of the HGLA are shown in Table 3.19-1.

Table 3.18-1 Historic Daily Traffic Volumes near the HGLA

Route and Location	1996	1997	1998	2000	2001	2002	2003	2004	2005	2006
US 395 at SR 190	5,600	5,900	5,200	5,800	5,600	5,500	5,900	6,200	6,050	6,400

Source: Caltrans Traffic and Vehicle Data Systems Unit.

The corresponding existing peak hour LOS on state and federal road facilities in the vicinity of the HGLA are shown in Table 3.19-2.

Table 3.18-2 Peak Hour Level of Service on Roadway Facilities near the HGLA

Route and Description	Peak Hour Volume (two-way)	Truck Percentage	Concept LOS	Current LOS
US 395 at SR 190	1,020	12 %	B	D

Note: **Bold** indicates that the current LOS does not meet the Concept LOS.

Source: Caltrans Traffic and Vehicle data Systems Unit and Fehr & Peers 2008.

Although no comparable daily traffic volumes, or peak hour traffic counts, are available for US 395 in the immediate vicinity of the HGLA, it is assumed that both may be similar in the vicinity of the latter due to the similarity of the highway design and the absence of any feeder roads which would significantly alter these traffic volumes.

As shown in Table 3.19-2, the two-lane segments of US 395 at SR 190 operated worse than at the design Concept LOS B for this highway segment. The observed peak hour LOS at this monitoring location was LOS D based on the Highway Capacity LOS chart for a two-lane highway on rolling terrain, and assuming that no passing zones comprise 80 percent of the routes. LOS D is a zone that approaches unstable flow, with tolerable operating speeds, although driving speed can be considerably affected by changes in operating conditions. To achieve the desired Concept LOS B, additional highway capacity would be necessary. No comparable average annual daily traffic volumes or peak hour flow rates are available for Coso-Gill Station Road or Sykes Road at Coso Station.

3.19 SOCIOECONOMICS

3.19.1 Applicable Regulations, Plans, Policies/Management Goals

Few management goals for social or economic conditions or environmental justice in existing land use plans cover the HGLA.

Inyo County's Economic Development Element in the Inyo County General Plan (2001) addresses primarily tourism and redevelopment. However, one of its goals and related policy is relevant to the HGLA alternatives:

“Goal ED-4: Actively encourage the expansion of existing industry of all types (including resource industries, manufacturing and service industries), and actively recruit new businesses that will bring new jobs to the County; **Policy ED-4.1 Mining Industry** Support the continued operation of existing mining activities within the County as well as new mining in appropriate areas, subject to each operator meeting all applicable safety and environmental laws, regulations, and County policies.”

3.19.2 Affected Environment

Most of the anticipated economic and social effects associated with the exploration and development of the HGLA would occur in an area within about 60 miles to the north and south (i.e., within about an hour commuting distance) of the HGLA (Figure 3.20-1). This Socioeconomic Study Area (SSA) is based on reasonable work-home commuting distances for local residents or workers who may move to the area for work at any future geothermal projects. There is limited east-west accessibility into this area due to the barriers presented by the Sierra Nevada Range, the Inyo Mountains, and the Coso Range so that development generally runs along a north-south axis, largely serviced by US 395. A little over half of the SSA falls within Inyo County, with the remaining area falling primarily within northeastern Kern County, and a very small portion in northwestern San Bernardino County. The HGLA and its corresponding SSA are shown in Figure 3.20-1.

3.19.2.1 Regional Setting

Inyo County, with a 2009 population of 18,049, was formed in 1866 from parts of Mono and Tulare Counties, California. The City of Bishop, with a 2009 population of 3,536 individuals and lying north of the 60-minute SSA, is the only incorporated city in the county.

The portion of the SSA within southern Inyo County is dominated by the Owens Valley and the Rose Valley. In Inyo County, these valleys are sparsely populated, but in the Indian Wells Valley of northeastern Kern County, incorporated cities within an hour's drive of the HGLA include Ridgecrest and California City. Mojave is an unincorporated Kern County community within the SSA.

The China Lake Naval Air Weapons Station (NAWS) is also located in the Indian Wells Valley. China Lake NAWS is located in southern Inyo County to the immediate east of the HGLA, and includes portions of northwest San Bernardino and northeastern Kern Counties; it had a 2008 employment of 5,608 individuals (Greater Antelope Valley Economic Alliance 2009). Historically, the area of the Rose Valley, now occupied by the NAWS, had only scattered ranches.

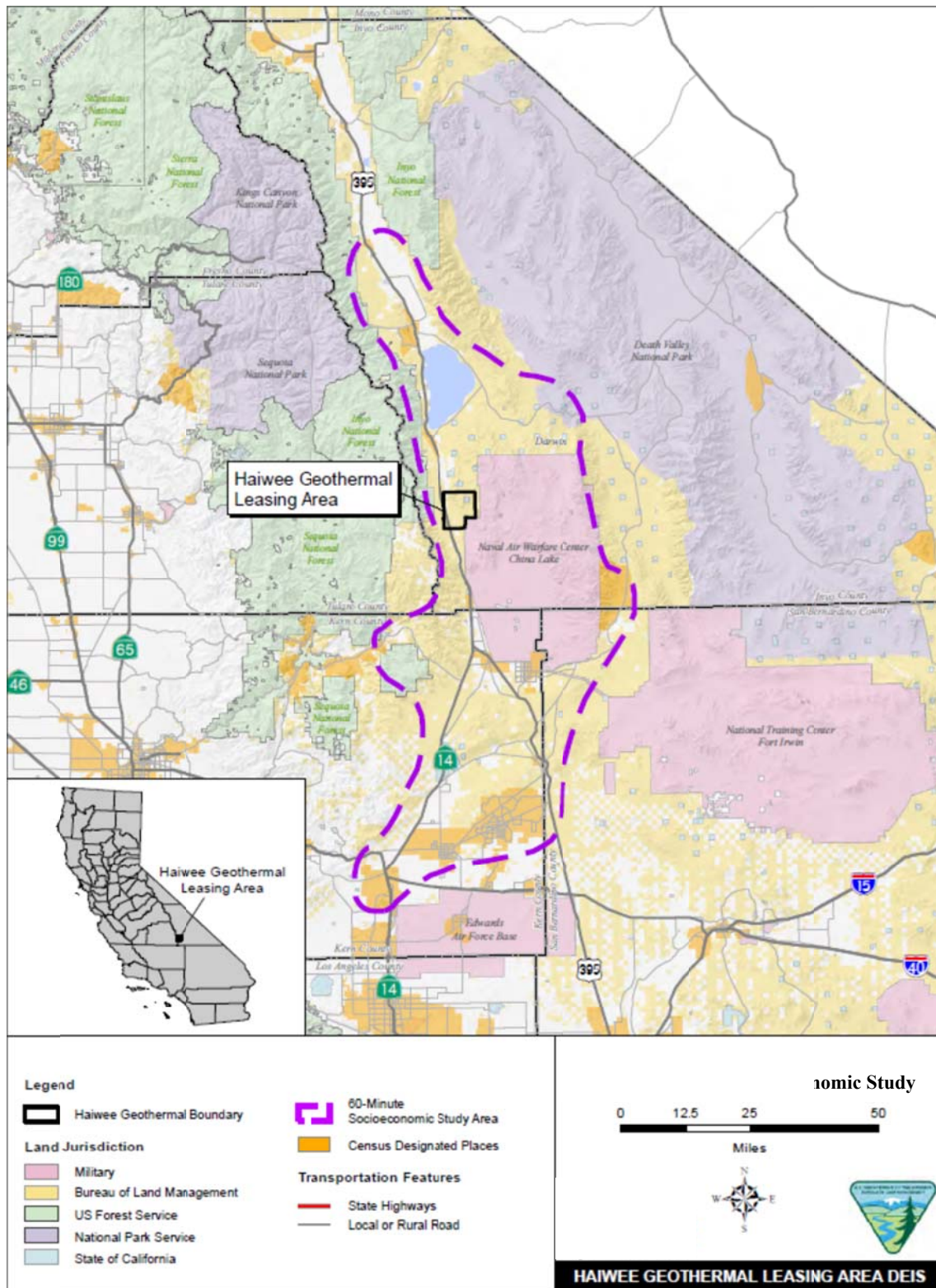
Further south within the SSA in Kern County is the Antelope Valley, a broad valley extending from Ridgecrest at its northern point south to the Angeles National Forest. Only the very northern portion of the Antelope Valley falls within the SSA; this northern portion of the Antelope Valley is referred to as Indian Wells Valley. Prior to the establishment of the Naval Ordnance Test Station at Inyokern in 1941 (now part of China Lake NAWS), Ridgecrest, with a 2009 population of 28,353, consisted of a few scattered farms and homesteads. Ridgecrest evolved during the 1950s and 1960s as a support community to the mission of NAWS by providing housing and services for federal employees and contractors. Ridgecrest was incorporated in 1963, and serves as the shopping and business center for northeastern Kern County as well as southern Inyo and northwestern San Bernardino Counties. The only other city within the SSA is California City (2009 population of 14,828). California City was founded in May 1958, and incorporated on May 25, 1965. A "planned" community, California City is the third largest incorporated city in California in terms of land area, and the eleventh largest in the United States.

Kern County, with a 2009 population of 827,123, was formed in 1866 from parts of Los Angeles and Tulare Counties. Only the far northeastern, relatively sparsely-populated portion of Kern County lies within the SSA.

A small portion of the SSA also extends into San Bernardino County. This area is extremely rural, with the exception of only the unincorporated communities of Red Mountain, Trona, Johannesburg, and Randsburg. Neither of these communities is a Census Designated Place (CDP) but they are included in the Red Mountain-Trona Census County Division (CCD).

In summary, the HGLA SSA is isolated from major economic hubs such as Bakersfield, approximately a two hour drive west of the SSA, and Los Angeles and Las Vegas, both of which are approximately four-hour drives from the SSA.

Figure 3.19-1 HGLA 60 Minute Socioeconomic Study Area



3.19.3 Existing Conditions

3.19.3.1 Population

The HGLA SSA is, on average, very lightly settled, with only two small incorporated cities (Ridgecrest and California City), and a few small, unincorporated communities (Independence, Big Pine, and Lone Pine in Inyo County; Lake Isabella and Inyokern in Kern County; and Red Mountain, Trona, Johannesburg, and Randsburg in San Bernardino County). The rest of the communities include dozens of very small settlements of up to a few hundred people. Due to the very rural nature of this area, population estimates are not made between decennial counts except for in the incorporated cities. Thus, Table 3.20-1 displays mostly Year 2000 data, except where more recent estimates are available from the California Department of Finance (CDOF). These data are also provided for some communities lying just outside the 60-minute SSA such as the Bishop and Death Valley CCDs in Inyo County, the Mojave and Lake Isabella CCDs in Kern County, and the Barstow-Victorville CCD in San Bernardino County.

Table 3.19-1 Historical Population Trends in the HGLA SSA and other areas outside the SSA

COUNTY/CITY/CCD/CD P (1)	2000 (2)	2005	2009	Average Growth, 2000-09	Annual
Inyo County					
County Total	18,071	18,410	18,049	0.0%	
<i>Bishop CCD</i>	12,216				
Bishop (incorporated)	3,575	3,608	3,536	-0.1%	
West Bishop CDP	2,807				
Dixon Lane Meadow Creek	2,702				
Mesa CDP	214				
Round Valley CDP	278				
Wilkerson CDP	562				
<i>Death Valley CCD</i>	638				
Furnace Creek CDP	31				
Shoshone CDP	52				
Tecopa CDP	99				
<i>Independence CCD</i>	2,612				
Big Pine CDP	1,350				
Independence CDP	574				
<i>Lone Pine CCD</i>	2,479				
Lone Pine CDP	1,655				
Cartago CDP	109				
Darwin CDP	54				
Homewood Canyon Valley	75				
Keeler CDP	66				
Olancho CDP	134				
Kern County					
County Total	661,653	753,698	827,173	2.5%	
<i>East Kern CCD</i>	69,614				
Ridgecrest (incorporated)	24,927	27,427	28,353	1.4%	
Randsburg CDP	77				
California City (incorporated)	8,385	11,510	14,828	6.5%	
<i>Mojave CCD</i>					
Inyokern CDP	984				
Johannesburg CDP	176				
Edwards AFB CCD					
Bakersfield (incorporated)	246,899	296,108	333,719	3.4%	
San Bernardino County					
County Total	1,710,139	1,946,312	2,060,950	2.1%	
<i>Red Mountain-Trona CCD</i>	2,293				
<i>Barstow-Victorville CCD</i>	285,337				
Barstow (incorporated)	21,119	23,652	24,213	1.5%	
California (mil)	33.9	36.7	38.3	1.4%	

Source: California Department of Finance (CDOF 2009a) and United States Department of Commerce (2000) for year 2000 data.

The data in Table 3.20-1 show that Inyo County's population has essentially not grown over the past decade. In contrast, population growth in eastern Kern County was slow but evident. Ridgecrest showed an average annual growth rate (AAGR) of 1.4 percent, and growth was rapid in California City with an AAGR of 6.5 percent. As a result, some population growth likely occurred in the nearby Kern and San Bernardino unincorporated communities as well. In the recent past (1990s), the population of Ridgecrest has fluctuated greatly as staff and spending at the China Lake NAWS has changed with available federal funding.

To provide an approximate population estimate for the HGLA SSA, zip code data from the Census 2000 were used. Although not precisely the same as the exact area within a 60-minute SSA, the area represented by the summed zip codes comes reasonably close to it. Aggregating the appropriate zip codes, the 2000 population of the HGLA SSA is estimated at 55,000 individuals. These estimates are shown in Table 3.20-2.

These data also include population density estimates. The zip code area in which the HGLA is located (Olancho) had a very low population density of 0.9 persons per square mile. This density contrasts with an overall average of 10.6 persons per square mile in the total zip code area (a low population density). The communities of Ridgecrest, California City, Trona, and Lone Pine were the only zip code areas with other low-density urban type densities. Lone Pine is the only one of those located in Inyo County.

Although no further official estimates of the zip code populations have been made, it seems likely that the 2009 populations for Inyo County changed very little from the 2000 population of 5,231. (This assumes that the growth rate in the Inyo County portion of the SSA is similar to that of the rest of Inyo County.) In contrast, the growth in the Kern and San Bernardino populations has probably been on the order of 20 percent during the same period, yielding a current population estimate of about 65,000 persons.

Table 3.19-2 Census 2000 Populations by Zip Code

Zip Code	Area Name	County	2000 Population	Persons per Square Mile
92328	Death Valley-Homewood Canyon-Valley Wells	Inyo	442	0.2
93513	Big Pine	Inyo	1,816	7.2
93522	Darwin	Inyo	59	1.5
93526	Independence	Inyo	723	12.3
93545	Lone Pine	Inyo	1,890	45.5
93549	Olancho	Inyo	301	0.9
INYO COUNTY TOTAL			5,231	1.9
93255	Onyx	Kern	653	2.5
93283	Weldon	Kern	1,920	7.3
93501	Mojave	Kern	4,873	12.1
93505	California City	Kern	8,311	77.1
93527	Inyokern	Kern	2,196	2.1
93554	Randsburg	Kern	105	1.7
93555	Ridgecrest	Kern	29,762	115.5
KERN COUNTY TOTAL			47,820	19.9
		San		
93562	Trona	Bernardino	1,988	57.6
TOTAL			55,039	10.6

Source: United States Department of Commerce (2000).

Population Projections

Population projections for the three counties in the SSA call for continued growth above statewide projected rates for Kern (AAGR of 2.2%) and San Bernardino (1.3%) counties, which are slower than their 2000-2009 AAGRs. Continued lower-than-statewide growth for Inyo County (0.7%) is projected, but this is above its zero percent growth assumed since the year 2000. The projection for the state is for an AAGR of 1.1%. Population projections are shown in Table 3.20-3.

Table 3.19-3 Population Projections, HGLA SSA Counties, to 2050

	2000	2010	2020	2030	2040	2050	Avg. Annual Growth Rate 2010-50
Inyo County	18,181	19,183	20,495	22,132	23,520	25,112	0.7%
Kern County	665,519	871,728	1,086,113	1,352,627	1,707,239	2,106,024	2.2%
San Bernardino County	1,721,942	2,177,596	2,581,371	2,958,939	3,309,292	3,662,193	1.3%
California	34,105,437	39,135,676	44,135,923	49,240,891	54,226,115	59,507,876	1.1%

Source: State of California, Department of Finance (CDOF 2007).

It should be noted that the socioeconomics of the SSA within Kern and San Bernardino Counties may have more in common with rural Inyo County than with the more populous, agricultural, or urban areas of Kern and San Bernardino counties.

Published population projections specific to the HGLA SSA do not exist. But it is assumed that very little growth would occur in the southern Inyo County portion of the SSA, perhaps at the projected county-wide rate of 0.7 percent; however, until an economic recovery takes hold in the county, this assumed rate may be high. The Greater Antelope Valley Economic Alliance (2009) has published some projections for some of the subareas and zip codes in the Kern County portion of the SSA, which can serve as proxies for the entire area. These projections, shown in Table 3.20-4, call for only 0.2 percent AAGRs through the year 2030. In sum, the population projection for the Haiwee SSA through the year 2020 would be for very limited growth, amounting to perhaps only a few thousand more than its estimated 2009 population of about 65,000 persons.

Table 3.19-4 Population Projections, by Zip Codes, within the Kern County Portion of the Haiwee SSA

	2010	2020	2030	Average Annual Growth Rate
93501 Mojave	4,619	4,713	4,369	-0.3%
93527 Inyokern	1,904	1,866	2,268	0.9%
93554 Randsburg	45	39	298	9.9%
93555 Ridgecrest	30,965	31,602	31,084	0.0%
93505 California City	11,791	12,267	13,283	0.6%
Totals	49,324	50,487	51,302	0.2%

Source: Greater Antelope Valley Economic Alliance (2009).

3.19.3.2 Social Environment

The characteristics of the social environment in the HGLA SSA were identified using secondary source data. Primary data or additional secondary data will be provided, as needed, in future, project-specific permit studies.

The social environment of the HGLA, like most of southern California, is ethnically diverse and multicultural. Although the HGLA lies in Inyo County, the broader social environment also includes portions of Kern and San Bernardino Counties that would capture much of the direct and indirect economic benefits of personal income and employment from developments in the HGLA. This broader three-county area has a population of about 2.9 million people; impacts compared in this broader context would be unnoticeable.

Lifestyles in this region reflect the communities' rural character, the region's ranching history and economy, the influence of China Lake NAWS, the population's multicultural character, and its draw for outdoor recreationists (which in turn depends on maintenance of the area's environmental amenities). The ample natural resources of this region such as its parks and varied desert and mountain landscapes attract visitors from nearby counties and states. The history of water rights issues, particularly in the Owens and Rose Valleys in Inyo County, further indicates that area residents are keenly interested in the area's natural resources. Scoping comments for this EIS focused heavily on concerns for the HGLA's potential impacts on groundwater resources, and general consumptive water needs.

3.19.3.3 Demographics

The specifics of the region's demography and economy are detailed in the following sections. These demographic and economic data offer a basis from which to assess the potential socioeconomic effects to the HGLA in the following chapter.

As described above, the HGLA SSA includes the lower Owens River Valley, Rose Valley, and Indian Wells Valley (northern Antelope Valley). Census 2000 racial and ethnic data for the broader three-county area and CCDs within the SSA are shown on Table E-1 in Appendix E. The corresponding age and gender compositions are shown in Table E-2. In summary, the CCDs shown in Appendix E, Table E-2, show a higher retirement-age, lower working-age, and higher under-18 populations in the Haiwee SSA than for the state as a whole. The workforce in the region also evidenced good competencies in high school and college education, but somewhat lower post-secondary accomplishment, based on the year Census 2000 data for persons over 25 years old. These data are summarized in Table E-3 in Appendix E.

3.19.3.4 Housing

This section examines housing supplies and occupancy in the SSA, focusing on the area within 60 minutes' drive of the HGLA. The reason for this geographic focus is that workers who may relocate to the area to work at future geothermal facilities will most likely prefer to live within commuting distance of such facilities, probably no more than an hour drive away. These in-migrating workers would require housing availability as well as local public services and facilities such as police and fire protection, schools, and water and sewer facilities.

During the temporary construction phase, the workers at the site are likely to prefer transient facilities (hotels and RV/mobile home parks). Workers with long-term jobs are likely to choose rentals or for-sale housing. Therefore, the availability of such housing is of prime importance in establishing sufficient capacity for these demands. Thus, both transient and long-term housing needs are addressed in this section.

Rental and Ownership Housing

Recent reliable and detailed rental and ownership housing data are not available for the HGLA SSA. The available standard data set comes from Census 2000, now out-of-date. They do, however, provide order-of-magnitude estimates of available rental housing stocks in the HGLA. These data are presented in Table 3.20-5.

In 2000, the stock of vacant housing-for-rent in the 60-minute SSA was 1,680 units. In contrast, 334 vacant units were for sale in the area. The overall rental vacancy rate was 6.5%, above the 5% threshold generally considered to constitute a tight rental market. Thus, even though Inyo County's overall rental vacancy rate was 8.5%, there was little availability due to its small stock of rental housing of only 929 total rental units.

According to the CDOF, about 208 housing units (rental and ownership) were added to the unincorporated housing supply between 2000 and 2008. For 2008, the CDOF reported a vacancy rate (combined rental and ownership) of about 16 percent in unincorporated Inyo County (CDOF 2009b). These data tend to confirm the general level of available rental units in Inyo County, based on the Census 2000 data of about 1,700 units; however, very few appear located in the SSA portion of Inyo County.

If the Census 2000 data are generally indicative of current and likely future baseline conditions, the main availability of vacant rental housing lies to the south of the HGLA in Kern County. Ridgecrest, with 940 vacant rentals available in 2000, and California City with 220 vacant rentals, are the closest areas to the HGLA; both had double-digit rental vacancy rates. In San Bernardino County, the Searles Valley area had 204 rental vacancies and a high rental vacancy rate of 44.3%.

Hotels and Other Transient Housing

In general, southern Inyo County has limited hotel, motel, and RV capacity. Ridgecrest, in neighboring Kern County, has the bulk of the available hotel and motel rooms. Within the Inyo County portion of the 60-minute SSA, availability of transient accommodations is limited almost entirely to Lone Pine, about a 40-minute drive from the HGLA. Lone Pine has a total of 311 hotel and motel rooms in about ten hotels. However, in the peak demand period of April to October, all its rooms are typically booked in advance. During the remaining off-season months, occupancy rates are reported at 75-80 percent (Lone Pine Chamber of Commerce 2009, personal communication), leaving about 65-80 rooms available, on average.

The two motels in Olancho have a total of 20 rooms, but are generally fully booked during the April-October peak season, with generally only a few vacancies in the off-season (The Rustic Hotel 2009, personal communication).

Table 3.19-5 Census 2000 Housing data, HGLA SSA

			Occupied Units			Vacant Units Only								
Zip Code		TOTAL UNITS	Total	Renter occupied	Average household size	Total	For rent	Vacancy rate	For sale only	Rented or sold, not occupied	For seasonal, or recreational, or occasional use	For migrant workers	Other vacant	
92328	Death Valley- Homewood Canyon- Valley Wells	340	248	187	1.78	92	2	1.1%	3	0	3	0	84	
93513	Big Pine	840	725	174	2.44	115	14	7.4%	18	7	36	0	40	
93522	Darwin	54	40	13	1.48	14	0	0.0%	0	0	11	0	3	
93526	Independence	431	342	103	2.11	89	18	14.9%	12	3	37	0	19	
93545	Lone Pine	977	806	328	2.31	171	44	11.8%	13	32	49	0	33	
93549	Olancho	149	112	45	2.69	37	1	2.2%	3	1	10	0	22	
INYO COUNTY TOTAL		2,791	2,273	850	2.27	518	79	8.5%	49	43	146	-	201	
93255	Onyx	393	279	53	2.34	114	11	17.2%	12	4	53	0	34	
93283	Weldon	1,180	850	152	2.26	330	11	6.7%	38	17	209	2	53	
93501	Mojave	2,344	1,820	760	2.66	524	113	12.9%	43	28	98	0	242	
93505	California City	3,525	3,038	1,001	2.72	487	220	18.0%	123	23	32	0	89	
93527	Inyokern	1,212	926	182	2.37	286	44	19.5%	23	25	108	1	85	
93554	Randsburg	130	61	12	1.72	69	0	0.0%	14	0	12	0	43	
93555	Ridgecrest	13,646	11,769	3,970	2.5	1,877	947	19.3%	223	171	113	1	422	
KERN COUNTY TOTAL		22,430	18,743	6,130	2.53	3,687	1,346	18.0%	476	268	625	4	968	
93562	Searles Valley (SAN BERNARDINO COUNTY TOTAL)	1,237	785	257	2.53	452	204	44.3%	44	13	21	0	170	
TOTALS		28,931	24,066	24,066	2.27	4,865	1,680	6.5%	28,931	334	807	4	1,459	

Source: United States Department of Commerce (2000a).

Two recreational vehicle (RV) and mobile home parks are in the vicinity of the HGLA. These two parks contain 140 RV spaces combined. Like the hotels in southern Inyo County, these spaces are usually fully booked during the April-October peak season. In contrast, a total of only about 40 sites have historically been occupied in the off-season, although periodic construction projects such as the current Owens Lake dust control project can result in full or near-full occupancy (Boulder Creek Mobile Home and RV Park 2009, personal communication; Olancho RV and Mobile Home Park 2009, personal communication).

The nearest concentration of hotels and motels to the south is in Ridgecrest. Ridgecrest has nearly 1,000 total hotel rooms among the 16 hotels that were identified in an internet search. This total should increase to 1,100 rooms when two more hotels are completed in 2010. The Ridgecrest market is based primarily on activities and programs at China Lake NAWS, and only secondarily upon other business visitors and tourists. Major activities such as the “Empire Challenge” at NAWS (an international military competition) in July, and periodic film shoots bring in substantial numbers of hotel guests. The desert wildflower bloom in the West Mojave Desert, during March, April, and May, can often be a significant attraction to the area. At these times the city’s rooms can be near-fully booked, but a fairly limited number of rooms can generally be found at other times during the April-October peak season (Ridgecrest Area Convention and Visitors Bureau, November 20, 2009, personal communication). Based on conversations with individual hotel personnel, substantial vacancies can be found in the off-season. The overall year-around occupancy rate in all Ridgecrest Hotels is estimated at 65 percent, with an estimated vacancy rate of 50 percent, on average, during the off-season.

3.19.3.5 *Economic Conditions*

Kern and San Bernardino Counties are geographically large, with the Haiwee SSA’s 60-minute area encompassing only very small portions of their territory. Since employment and income time-series data are tabulated primarily at the much broader county level, these county-wide data may not be very applicable to the smaller SSA, although some inferences can be drawn from some historic data.⁴ However, the Haiwee SSA does incorporate a significant portion of Inyo County and, as a result, county-wide data for Inyo County may be somewhat more indicative of conditions in the Haiwee SSA. This section presents the available employment and income data describing past and current economic conditions in the three counties, with application to the smaller SSA conditions where appropriate.

As with most of the United States, the Haiwee SSA, and Southern California in general, experienced a recession that began in 2007. Although Kern County did not see total

⁴ Census 2000 employment and income data are tabulated from a household perspective to the level of Census Blocks, but are of limited usefulness in depicting 2009 conditions.

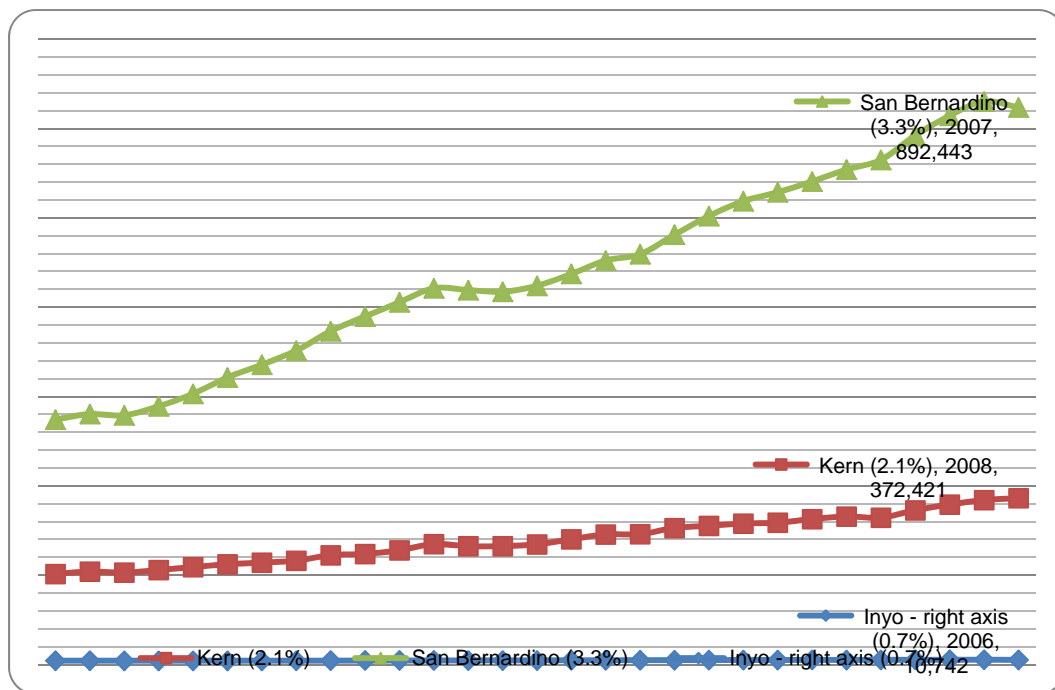
employment declines until 2009, healthy military and mining sectors in the region have compensated for the recession in the housing/construction industry. The historical data presented below are indicative of conditions before the third quarter of 2009, and therefore should be understood as depicting economic conditions 2007 to mid-2009.

Historical Employment

The three counties that contain the Haiwee SSA exhibited quite different employment trends from 1980 to 2008, the last full year for which data are available.⁵ Inyo County experienced very slow overall growth, at an AAGR of 0.7 percent, and peaking at 10,742 people in 2006 before declining somewhat in the recession years of 2007 and 2008. Kern County's AAGR was a healthy 2.1 percent, peaking at an estimated 372,421 individuals in 2008, and showing none of the declines from 2006 as observed in Inyo County. Kern County's growth was slightly above the Statewide AAGR of 1.9 percent. San Bernardino County's employment grew most rapidly at an AAGR of 3.3 percent, peaking at 892,445 individuals in 2007 before declining slightly in 2008. These data are shown in Figure 3.20-2.

⁵Based on United States Department of Commerce, Regional Economic Information System (REIS) data through 2007 and extrapolation to 2008 using California Employment Development Department (CEDD) data. REIS data include all employment, while the CEDD data capture employment covered by Federal Insurance Contribution Act (FICA) only.

Figure 3.19-2 Historical Employment, 1989-2009: Inyo, Kern, and San Bernardino Counties (peak historical value shown)



Source: United States Department of Commerce (2009) for figures through 2007. Estimated for 2008 using California Employment Development Department (2009) ratios for 2008 to 2007.

Monthly employment figures, between 2007-2009, also were reflected differently in the three counties.⁶ In Inyo County, employment after 2006 continued its decline with a larger drop through September 2009 than in 2007 or 2009. Kern County's employment declined in 2009, after growing in 2007 and 2008 contrary to national and state declines. The most significant declines occurred in San Bernardino County, which consistently continued its noticeable decline through September 2009. These data are shown in Figure 3.20-3.

Unemployment

When there is a larger pool of labor available to staff new developments, there is a lower need for hiring workers from other areas. The recent job employment declines have greatly increased the total number of unemployed persons in the broader three-county region as well as in the smaller Haiwee SSA. It should be remembered that Kern County is greatly influenced by seasonal agricultural jobs, unlike Inyo County. Current information on the unemployed workforce is summarized below.

⁶ These data are FICA-employment only and do not include proprietors and other employment categories as do the previous annual data, and therefore are numerically lower, but likely do accurately depict year to year trends.

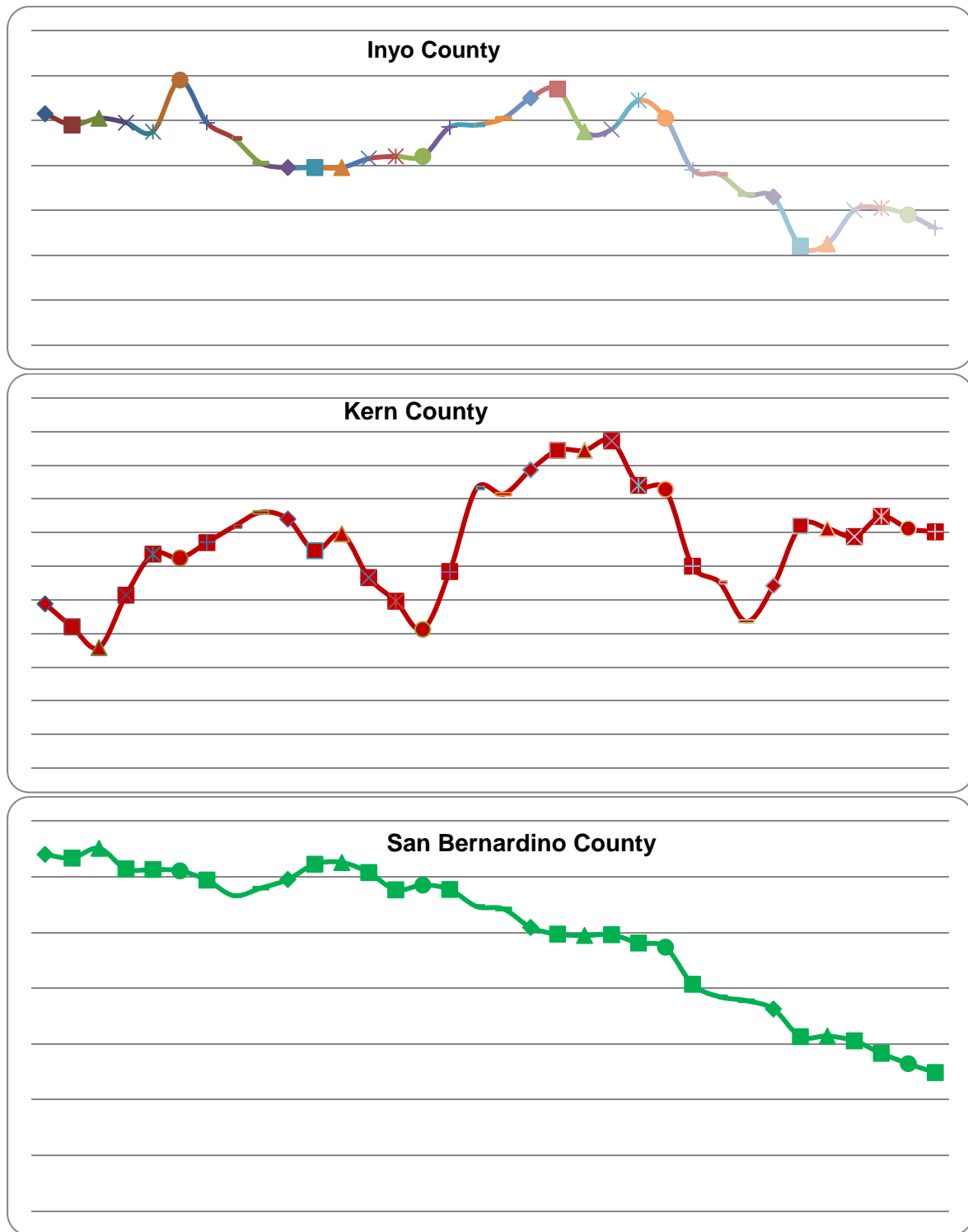
The recent employment conditions have increased unemployment rates in California to above those recorded in the 1991-93 recession, from a year-to-date 2009 average of 11.5 percent versus 9.5 percent in 1993 (Figure 3.20-4). For comparison, the annual average unemployment rate during the recession of the early 2000s peaked at a relatively low 7.4 percent statewide in 2003.

Since 1990, the employment trends in the three-county area have generally followed the pattern of peaks and valleys of the statewide unemployment pattern, with some notable differences. Through the mid-1990s, the statewide unemployment rate remained below those of all three counties. However, in the early 2000s, both Inyo and San Bernardino County unemployment rates became less than the statewide rates. By comparison, Kern County has always had the highest unemployment rate, well above the statewide average.

With the recent economic conditions, Inyo County's unemployment rate, while increasing, still remains below the statewide rate. San Bernardino County, which has been hit the hardest by the recession, again experienced higher-than-statewide unemployment rates. The 2009 year-to-date overall unemployment rate of 13.4 percent within the three counties is well above their historic average of about eight percent recorded since 1990.

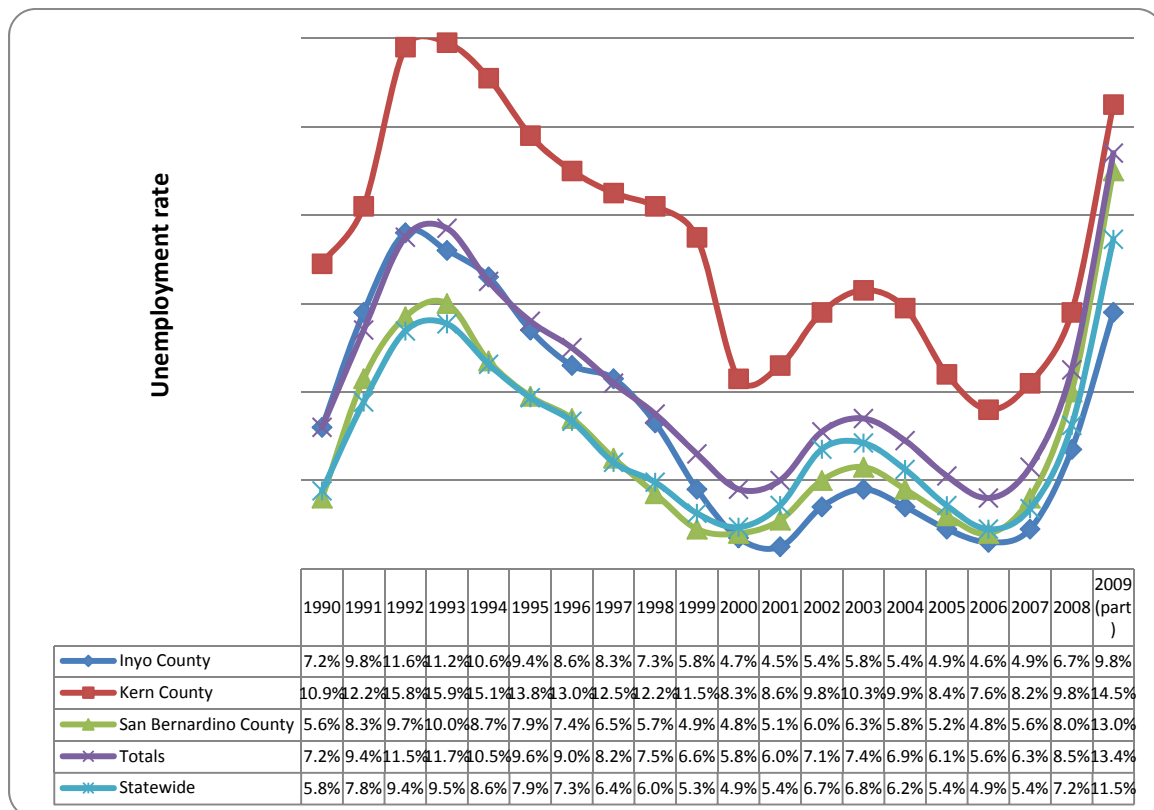
Inyo County has a very small unemployed work force. Before the recent recession, the historical average number of unemployed persons in Inyo County was less than 500 individuals. Currently, the number of unemployed persons is about 850. This relatively low increase in unemployment underscores the fact that although the HGLA is located in Inyo County, the county is unlikely to supply much of the labor needs of the any future projects envisioned under the Reasonably Foreseeable Development scenario.

Figure 3.19-3 Recent Historical Monthly Employment, 2007-2009: Inyo, Kern, and San Bernardino Counties



Source: California Employment Development Department (2009).

Figure 3.19-4 Historical Annual Average Unemployment Rates, 1990-2009: Inyo, Kern, and San Bernardino Counties, and Statewide



Source: California Employment Development Department (2009a).

Employment in the Haiwee 60-minute SSA

Employment in the HGLA SSA can be characterized based on California Employment Development Department (CEDD) estimates of employment by CDP. These estimates do not include employment outside of CDPs which, except for farm employment, is probably minimal. These estimates are also very rough because of the methodology used.⁷ CEDD employment and unemployment estimates for CDPs are displayed in Table 3.20-6.

The data in Table 3.20-6 consistently show unemployment rates in the HGLA SSA generally lower than for the three-county area as a whole. This is to be expected because the largest employer in the 60-minute SSA is the China Lake NAWS, where employment was insulated from the 2007-2009 recession, and increased slightly instead. In fact, the corresponding data for 2007 (not shown in Table 3.20-6) show that contrary to the county-wide condition,

⁷ The CEDD estimates use employment and unemployment ratios from the 2000 Census, applied to current-year total county employment and unemployment data. Since both employment and residence locations have changed in the ensuing years, but are implicitly held constant in the method, the results must be viewed as indicative-only.

employment in the smaller SSA actually increased from 2007 to 2008. Conversely, the HGLA SSA has a lower unemployment rate than the broader three-county area (6.8 percent versus the 8.5 percent shown in Figure 3.20-5). The result is that, in 2008, there were likely only about 1,800 unemployed persons in the HGLA 60-minute SSA, which probably increased to roughly 2,000 individuals in 2009.

Table 3.19-6 Estimated Employment and Unemployment, 2008: CDPs and Incorporated Cities in and near the HGLA SSA

Area Name	Labor Force	Employment	Unemployed	Unemployment Rate
Inyo County				
Big Pine CDP	690	640	50	7.2%
Darwin CDP	20	20	0	0.0%
Homewood Canyon Valley Wells CDP	10	10	0	0.0%
Independence CDP	320	300	20	6.3%
Lone Pine CDP	810	740	70	8.6%
Olancho CDP	80	80	0	0.0%
Total, CDPs shown	1,930	1,790	140	7.3%
Kern County				
California City (city)	4,900	4,600	300	6.1%
Inyokern CDP	600	500	100	16.7%
Johannesburg CDP	100	100	0	0.0%
Kernville CDP	700	700	0	0.0%
Mojave CDP	1,900	1,700	200	10.5%
Onyx CDP	200	200	0	0.0%
Ridgecrest (city)	15,800	14,900	900	5.7%
Total, CDPs shown	24,200	22,700	1,600	6.6%
San Bernardino County				
Searles Valley CDP	900	800	100	6.3%
TOTALS	27,030	25,290	1,840	6.8%

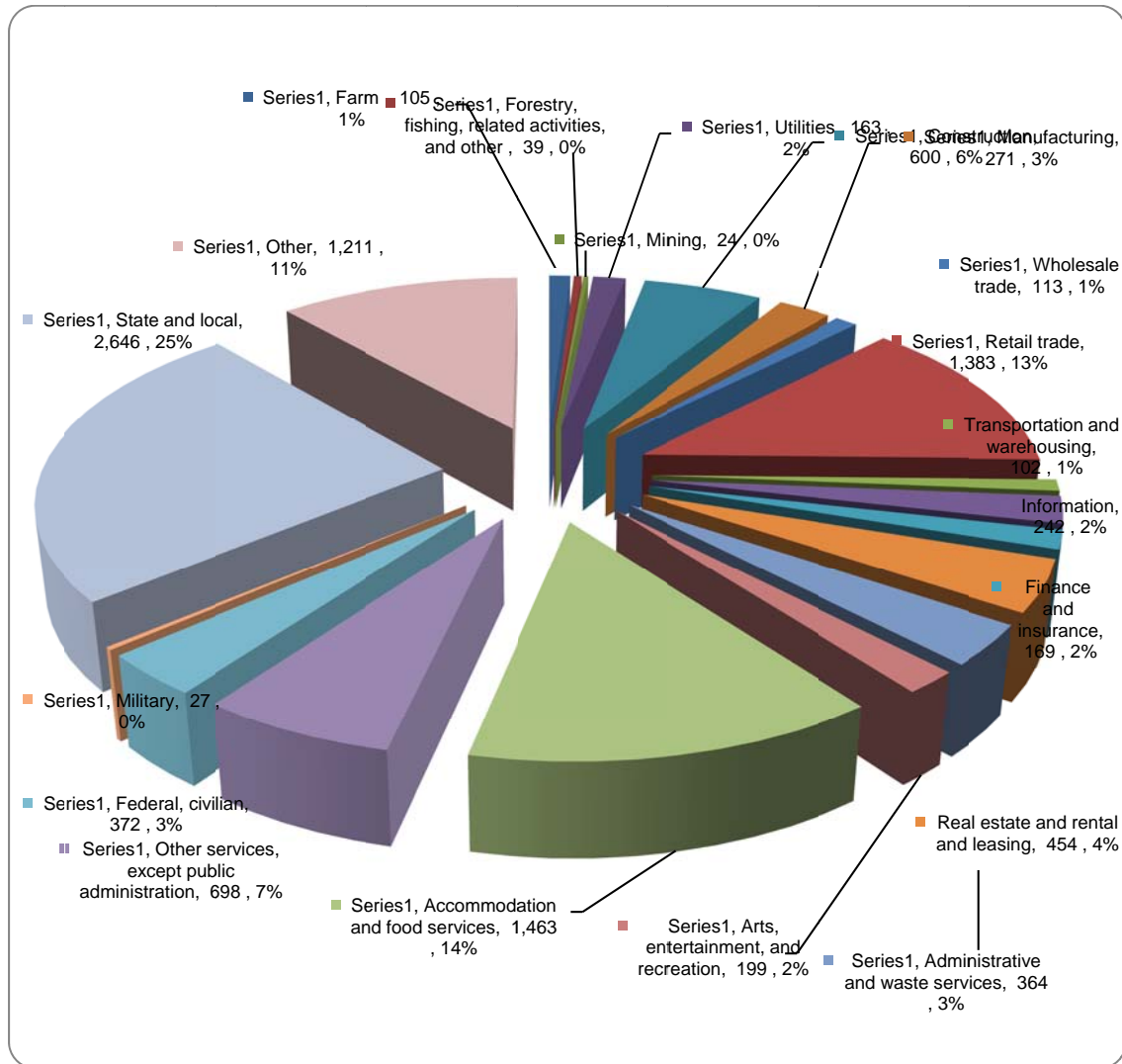
Source: California Employment Development Department (2009b).

Employment by Industry

The primary base industries in Inyo County (based on each industry's share of total employment compared to the statewide average) include accommodations/food services; retail trade; utilities; federal, state and local government. However, state and local governments are not really an export industry; this sector's high concentration relative to total County employment is primarily a result of Inyo County's size. In addition, China Lake NAWS employment is included in Kern County employment counts, though part of it lies in Inyo County, and the remaining Civilian Military employment counted in Inyo County is quite small (372 jobs in 2007). Finally, employment by the various utilities is also relatively

small. Thus, the tourism sectors of accommodations/food services and retail trade, which together accounted for over 3,000 jobs in 2007, are the main drivers of the Inyo County employment. Employment by industry data are shown in Figure 3.20-5.

Figure 3.19-5 Employment by Industry, Inyo County, 2007



Source: U.S. Department of Commerce, Regional Information System, 2009. CA25—Total Employment by Industry.

Notes: “Other” includes Professional, scientific, and technical services, Management of companies and enterprises, Health care and social assistance, and Educational services, data for which were suppressed due to confidentiality regulations.

Although agriculture is not a major sector of the Inyo County economy, its presence in the HGLA merits mention. At \$16.6 million in products, Inyo County ranks 53rd in California in the value of agricultural production. Cattle and cattle feed crops dominate its agricultural

activities. Thus, almost all the agricultural land in the county consists of low-intensity grazing land.

The prominent industries providing Kern County with its largest export base (based on each industry's share of total employment compared to the statewide average⁸) are agricultural and forestry services, farming, federal government facilities, and mining (including oil and gas exploration). None of these industries have numerically large employment, but they are critical to the overall health of the economy since they bring money into the economy which supports employment in local-market oriented industries such as retail trade and services (although larger sectors such as state and local governments and retail trade exist, they are not considered export industries). Until 2007, growth in Kern County's mining and federal civilian industries outweighed small declines in the farming and federal military sectors. This shored up total county employment so that some growth continued to occur.

The prominent export industries in San Bernardino County (based on each industry's share of total employment compared to the statewide average) are transportation and warehousing, federal military facilities, and administration services. Numerically, the retail trade and state and local governments are the largest sectors, but these serve local demands and are not part of the county's export base.

Since the construction skills required by the geothermal industry are expected to be similar to those in the mining and construction industries in the three-county area, local workforces in the construction and mining industries are briefly characterized below.

Both Kern and San Bernardino Counties have slightly larger construction sectors than the statewide average, reflecting their slightly higher population growth rates and roles as "exporters" of construction services. The national and statewide construction industry declines of 2007 and 2008 were also noted in the three-county area, which saw noticeable drops during the same period from the peak employment levels of 2006. These data are graphed in Figure 3.20-6. It is assumed that local construction employment declines have almost certainly continued, mirroring the statewide construction employment declines observed in 2009. Any increases in the 2010 or 2011 employment levels would depend on the strength of the current national and statewide economic recovery.

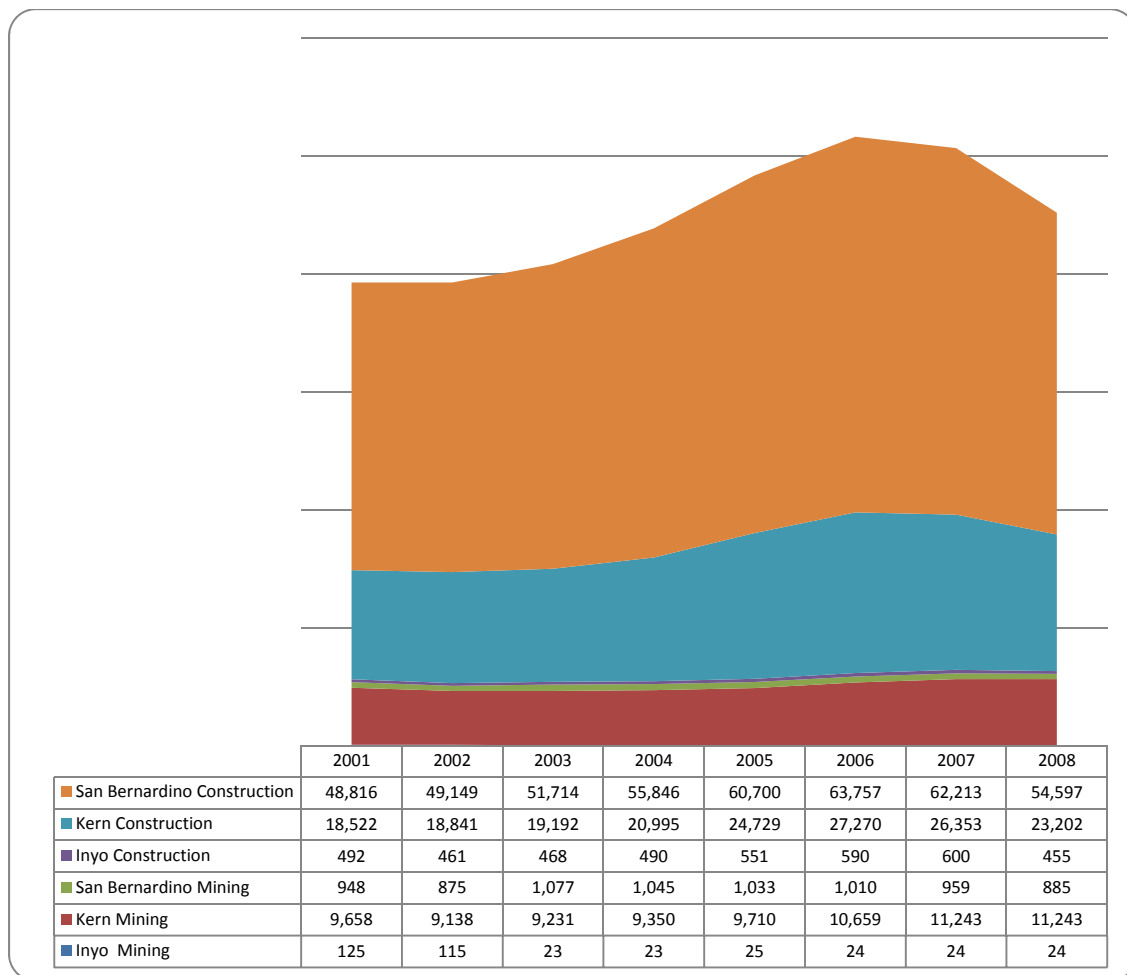
Construction employment in Inyo County makes up a slightly smaller proportion of its total employment compared to the statewide pattern, reflecting the general lack of growth in the county population. Of the total construction employment in the three-county area, San Bernardino County accounted for about two thirds in 2008, at about 55,000 jobs; Kern County accounted for about 22,000 jobs, while Inyo County accounted for only an estimated

⁸ This ratio is called a "location quotient".

455 jobs in 2008. In all three counties, declines in construction employment from 2006 to 2008 indicate there is probably some availability of unemployed construction workers in the area.

Kern County accounts for over 90% of mining (including oil and gas facilities) employment in the three-county area. Kern County mining employment was an estimated 11,243 in 2008; San Bernardino County accounted for an estimated 885 jobs, and Inyo County only 24, a noticeable drop from its 115 jobs in the early 2000s. Despite this drop, the health of the Kern County mining sector indicates that there is probably not significant excess unemployment in mining in the three-county region.

Figure 3.19-6 Mining and Construction Employment, Inyo, Kern, and San Bernardino Counties, 2001-2008



Sources: United States Department of Commerce (2009a). Updated to 2008 and estimated for Inyo County 2001 mining using California Employment Development Department (2009) data ratios for missing years in United States data by Economic Planning Resources.

Income

Per capita total personal incomes in Inyo County have historically been higher than in Kern or San Bernardino Counties, and also higher than statewide, non-metropolitan area averages. Furthermore, since 1990, Inyo County per capita total income growth has matched that of the statewide, non-metropolitan AAGR at 3.7 percent, while both Kern and San Bernardino per capita personal income growth has lagged somewhat, at 3.0 percent and 2.9 percent, respectively. Thus, by 2007, Inyo County residents had per capita total incomes of about \$34,000, compared to \$27,000 and \$28,000 in Kern and San Bernardino Counties, respectively. Per capita earnings from working in Inyo County were about \$19,000 in 2007, about the same as in Kern County; San Bernardino per capita earnings were about \$22,000 (U.S. Department of Commerce 2009b). The main reason for Inyo County's higher per capita total incomes are higher non-wage incomes, including personal current transfer receipts (e.g. retirement benefits), dividends, and interest.

These averages partly reflect Inyo County's popularity for high-wealth and/or retired persons who seek residence locations that are not necessarily near job opportunities, but have attractive environmental amenities. The scenic quality and good weather of Inyo County are strong attractions for such residents. This factor is also reflected in the relatively high proportion of housing "for seasonal, recreational, or occasional use", as second homes are defined by the United States Census. Such housing makes up 6.2 percent of the Inyo County housing stock, compared to 1.9 percent statewide, in the year 2000 (United States Department of Commerce 2000).

The 1999 distribution of income in the CCDs (the year of income data for the Census 2000) in which the HGLA SSA is located, is shown in Table E-4, in Appendix E. These data show that the HGLA SSA had a higher proportion of individuals and households in the lower income brackets, and a lower proportion in the higher income brackets, than in the three-county area as a whole. By contrast, the East Kern CCD had the highest per capita income, as well as the lowest proportions of individuals and households in the lower income brackets of the geographies shown in Table E-4 in Appendix E.

3.19.3.6 Economic Forecasts

Based on current economic conditions, recovery in the national employment picture is of uncertain timing and magnitude, and most forecasters call for a slow employment recovery, with little or no improvement through 2010 and only mild improvement in 2011. Forecasts for Southern California are similar (Los Angeles County Economic Development Corporation 2009).

Authoritative economic forecasts for Inyo County do not exist. However, Inyo County employment levels did decline somewhat in 2009. Since the county economy is dependent largely upon its tourist industry for growth, improvements in the next few years' employment levels are contingent upon a rebound in its visitor/hospitality industry to a great extent. Since employment is not expected to rebound rapidly in California or the United States as a whole, discretionary household income may not provide a sufficient basis for growth in the Inyo County tourist industry, or result in a rebound in its overall employment at least through 2010, and possibly in 2011.

Authoritative, recent economic forecasts for Kern County also do not exist. However, total Kern County employment did not decrease between 2007 and 2008 (Figure 3.20-4) despite employment declines in the construction industry, largely because government and mining employment increased. As with the rest of the country, Kern County's total employment did decrease in 2009. Depending on the magnitude of improvements in the construction industry, actual increases in Kern County employment, if any, may not be substantial in the next two years. Similarly, recovery in the housing construction industry is not expected to be rapid. According to the Los Angeles County Economic Development Corporation (2009), the Riverside/San Bernardino County SMA is expected to suffer continued job losses through 2010, as it had in 2007-08 and 2008-09 (Figures 3.20-3 and 3.20-4). Overall, economic conditions in the Riverside/San Bernardino County SMA are not expected to improve significantly until at least 2011. No specific forecasts are presented for 2012 and beyond, but it is clear that the five year future for San Bernardino County is unlikely to show drastic economic increases above conditions that prevailed in 2006.

3.19.3.7 Public Services

This section examines public services in three main areas of the HGLA SSA: Unincorporated Inyo County, in which the HGLA is located, and the region's only two cities, Ridgecrest and California City. The public services addressed include police protection, fire protection, emergency services/hospitals, public water supplies, sewage collection and treatment, waste disposal, and schools.

3.19.3.8 Fiscal Conditions

The government costs and revenues for Inyo County, and for the cities of Ridgecrest and California City in Kern County, are summarized in this section. The California fiscal crisis has contributed to extreme difficulties for nearly all municipalities across the state, and the local jurisdictions are no exception. One primary difficulty shared by all jurisdictions is the

California property tax limitation law, “Proposition 111”.⁹ However, the national recession and structural problems in the State, and the local expenditure and revenue processes, are also critical. It is notable that all three jurisdictions have planned 2010 General Fund expenditures in excess of projected General Fund revenues. This situation necessitates transfers from other funds, primarily their reserves, to balance current year budgets in each jurisdiction.

It is notable that Inyo County has a revenue resource that provides some relief from revenue shortfalls that is not available to most other localities: Geothermal lease royalties. A brief description of these lease royalties is included below.

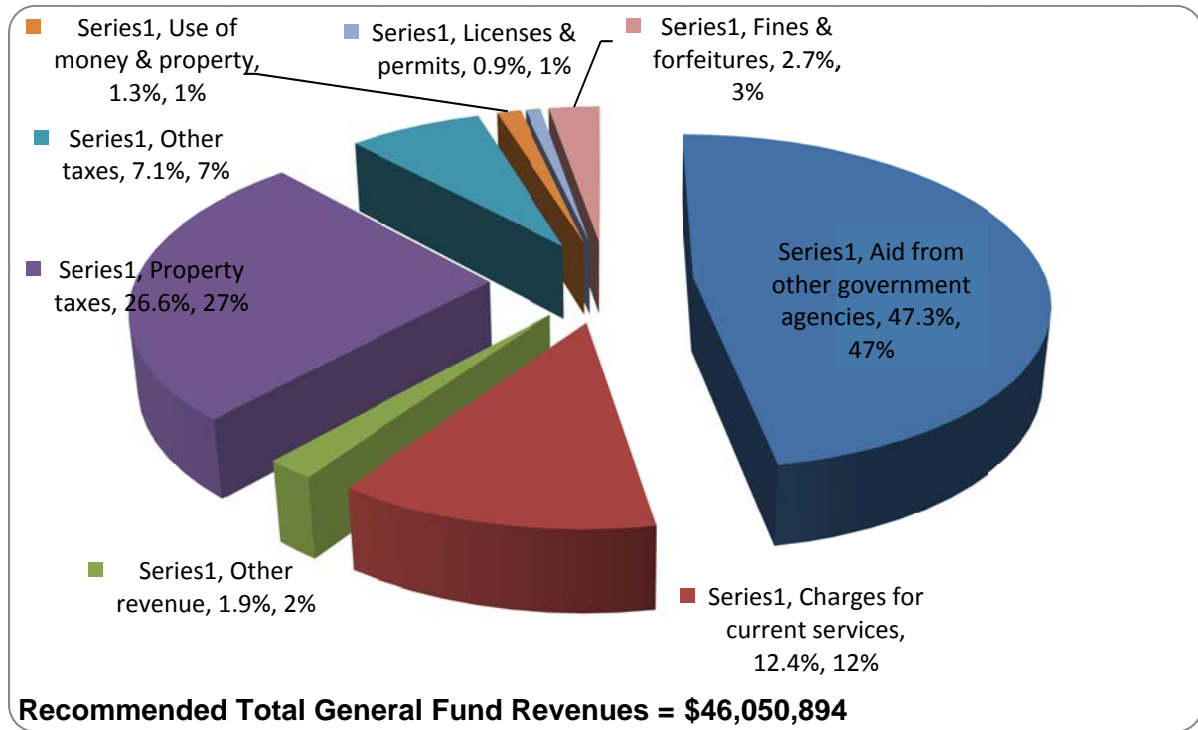
Inyo County

The Inyo County recommended budget for fiscal year (FY) 2009-10 totals \$80,500,512 in expenditures and \$74,473,660 in revenues. The General Fund portion of the recommended budget is \$49,931,303 in expenditures, and \$46,050,894 in revenues. These figures include use of \$3,880,409 in Fund Balance from Fiscal Year 2008-2009. General Fund expenditures represent an increase of \$1,082,094, or 2.22 percent over the FY 2008-09 Board Approved General Fund Budget of \$48,849,209.

Details on the General Fund recommended budget revenues and expenditures are shown in Figures 3.20-7 and 3.20-8. At 47 percent of its total budget, Inyo County depends heavily on aid from other governments for its revenue base. The second most important revenue source is property taxes, projected at 27 percent of its projected total General Fund revenues. Its expenditures are primarily for General Government (33 percent of its total General Fund expenditures), and for public protection (36 percent).

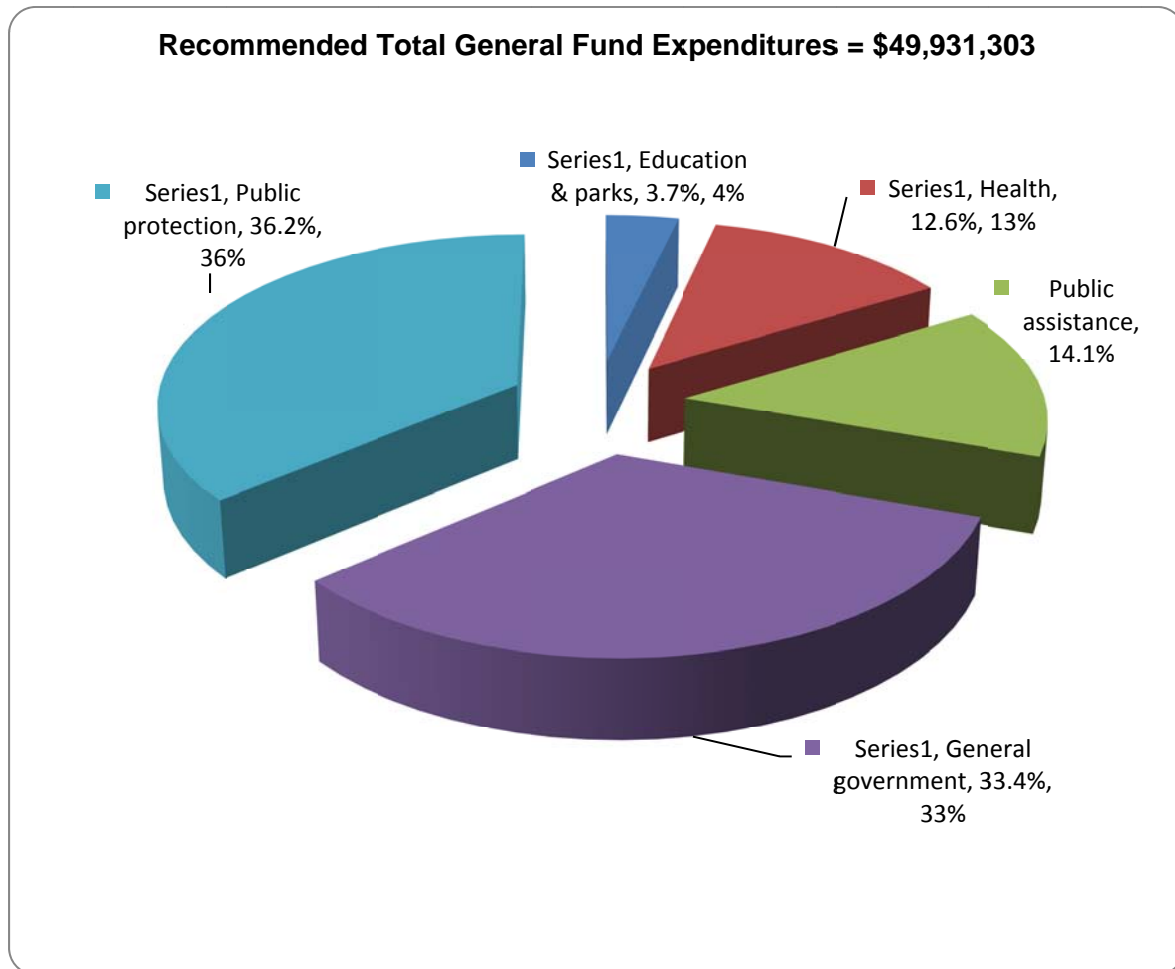
⁹ In June 1990, the voters modified the original Article XIII-B (Proposition 4/Gann Limit) with the passage of Proposition 111 and its implementing legislation (California Senate Bill 88). Beginning with the 1990-91 appropriations limit, a City or County may choose annual adjustment factors. The adjustment factors include the growth in the California per capita income or the growth in the nonresidential assessed valuation due to construction within the City, and the population growth within the County or the City. Under Proposition 4, if a city ends the fiscal year having more proceeds of taxes than the Limit allows, it must return the excess to the taxpayers within two years (either by reducing taxes levied or fees charged).

Figure 3.19-7 Recommended Total General Fund Revenues, Inyo County, Fiscal Year 2009-2010



Source: Carunchio 2009.

Figure 3.19-8 Recommended Total General Fund Expenditures, Inyo County, Fiscal Year 2009-2010



Source: Carunchio 2009.

As noted earlier, Inyo County receives revenues from geothermal royalties under the Geothermal Royalty Fund of the federal government. To date, these revenues have not been a large part of the revenue base, but this source may become more important in the future. All federal revenues from geothermal development are deposited in the Geothermal Resources Development Account (GRDA) within the General Fund. From these revenues, 40 percent is redistributed to the counties of origin, another 30 percent is transferred to the Renewable Resources Investment Fund, and 30 percent remains in the GRDA, which is made accessible to the California Energy Commission for grants or loans to local jurisdictions or private entities. A total of \$21,855,081 was distributed to California State and County governments in FY 2008 (Néron-Bancel 2009). In FY 2008, Inyo County received \$548,565.

Pursuant to county policy, operating transfers of geothermal royalties are only made from revenue already received in the Geothermal Royalties Fund, and do not rely on geothermal royalty revenue that is expected, but has yet to be received this fiscal year. The FY 2009-10 Inyo County recommended budget includes the above total of \$558,644 in Geothermal Royalties Fund Operating Transfers, \$449,644 of which was recommended in the planned budget to be used to off-set eligible expenses in the General Fund budget.

City of Ridgecrest

By comparison to the Inyo County data, the City of Ridgecrest's planned General Fund FY 2009-10 budget calls for an estimated \$11,407,559 in revenues. Taxes account for 67 percent of this total, but transfers from other funds are 19 percent of the total. With appropriation cuts of more than 20 percent to the departments in the General Fund, the FY 2009-10 would have an operating deficit. Therefore, the planned budget has been supplemented with minimal one-time-only funds to balance the planned expenditures of \$11,934,398.

The City relies to an important degree on development impact fees to pay for its expenditures. These impact fees include those for fire protection, traffic, parks, law enforcement, and drainage.

California City

California City's planned General Fund FY 2009-10 budget calls for an estimated \$6,222,583 in revenues. Special transfers account for 67 percent of this total, and property taxes are 17 percent of the total. Planned expenditures total \$6,984,380; General operating expenditures (35 percent) and police expenditures (31 percent) are the two largest expenditure categories.

3.19.3.9 Environmental Justice

Two Census Block Groups are located within six miles of the HGLA: In Inyo County, Block Group 3 (in Census Tract 6), and in Tulare County, Block Group 5 (in Census Tract 27). These Block Groups are shown in Figure 3.20-9.

Race and Ethnicity

The Environmental Justice data are derived from the Census 2000, as specified by the Council of Environmental Quality (1997) guidelines. According to the Guidelines, a significant minority population exists if minorities comprise 50 percent or more of the affected areas (within six miles of alternatives) general population. For this analysis, a racial minority is defined as any person counted by the Census as any race other than "White only."

In 2000, the total population living in the two Census Block Groups that lie entirely or in part within six miles of the HGLA was 647 individuals. Persons classified as White comprised

87.3% of the total. For comparison, Inyo County residents classified as White comprised 79.7% of its population, and in Tulare County, 57.9% (only a very small part of Tulare County is within the 6-mile radius). The second largest racial group in all Block Groups within six miles of the HGLA was “some other race alone,” at 7.7% of the total, followed by “two or more races” at 3.4%.

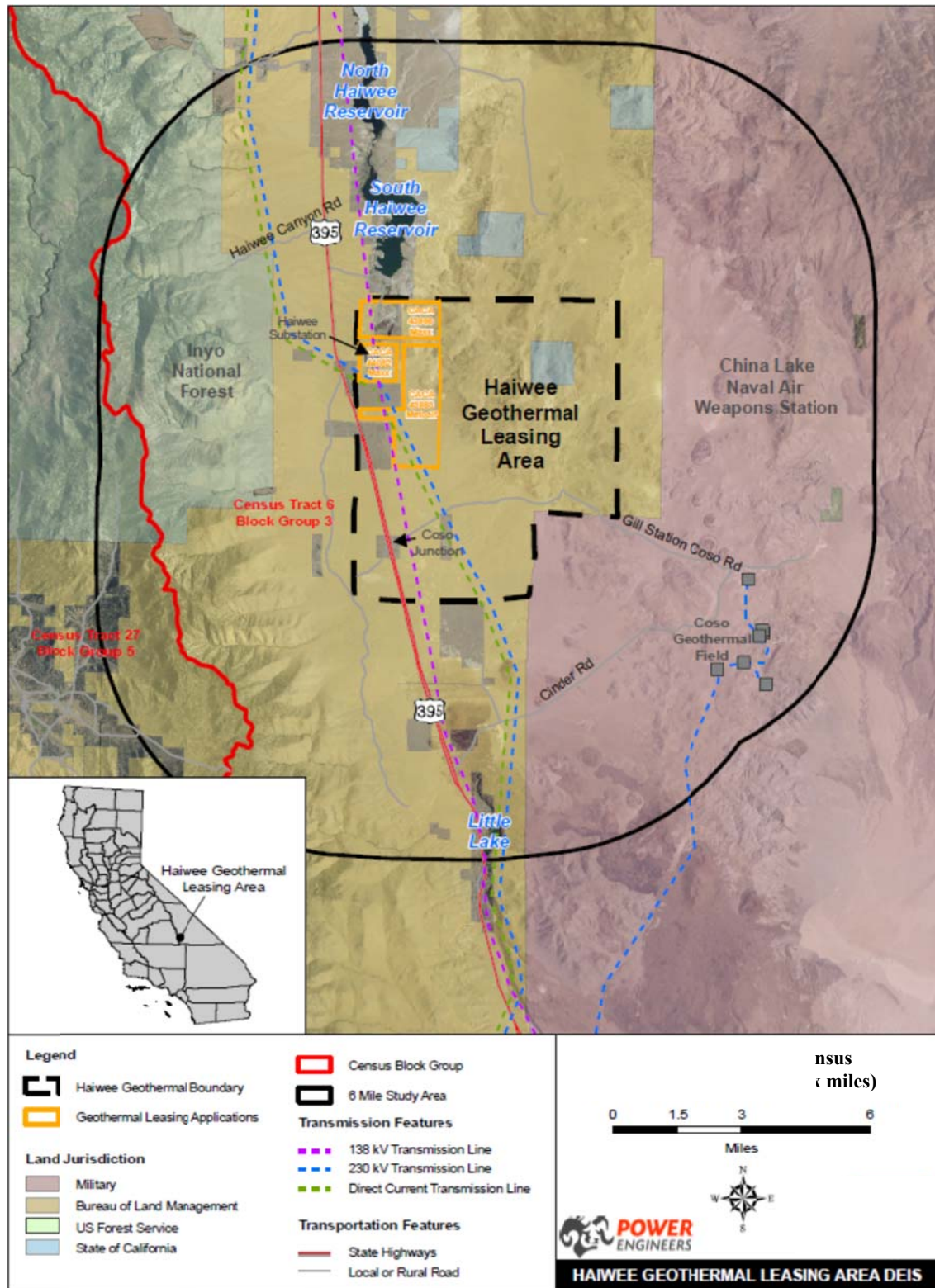
The ethnic group classified as “Hispanic or Latino” in the area within six miles of the HGLA comprised 14.1% of the total population. This is a slightly higher proportion than in Inyo County (12.5%), and substantially lower than Tulare County (50.8%). Table 3.20-7 summarizes race and ethnicity.

Table 3.19-7 Ethnicity and Race, Counties, Census Tracts, and Block Groups

	<u>Inyo County</u>	<u>Census Tract 6, Inyo County</u>	<u>Block Group 3, Census Tract 6, Inyo County</u>	<u>Tulare County</u>	<u>Census Tract 27, Tulare County</u>	<u>Block Group 5, Census Tract 27, Tulare County</u>	<u>Block Group 3, Census Tract 6 & Block Group 5, Census Tract 27 Combined</u>
Total Population	17,945	2,488	585	368,021	5,170	62	647
White alone	14,304	2,000	508	213,250	4,176	57	565
Black of African American alone	17	3	0	6,196	61	0	0
American Indian & Alaska Native alone	1,706	181	7	4,702	556	0	7
Asian alone	224	9	0	12,336	36	0	0
Native Hawaiian and Other Pacific Islander alone	16	0	0	280	3	3	3
Some other race alone	801	179	48	114,223	220	2	50
Two or more races	877	119	22	17,034	118	0	22
Hispanic or Latino	2,247	601	85	186,913	469	6	91
Percent Total Population:							
Total Population	100%	100%	100%	100%	100%	100%	100%
White alone	79.7%	80.4%	86.8%	57.96%	80.8%	91.9%	87.3%
Black of African American alone	0.1%	0.1%	0.0%	1.7%	1.2%	0.0%	0.0%
American Indian & Alaska Native alone	9.5%	7.3%	1.2%	1.3%	10.8%	0.0%	1.1%
Asian alone	1.2%	0.4%	0.0%	3.4%	0.7%	0.0%	0.0%
Native Hawaiian and Other Pacific Islander alone	0.1%	0.0%	0.0%	0.1%	0.1%	4.8%	0.5%
Some other race alone	4.5%	7.1%	8.2%	31.0%	4.3%	3.2%	7.7%
Two or more races	4.9%	4.8%	3.8%	4.6%	2.3%	0.0%	3.4%
Hispanic or Latino	12.5%	24.2%	14.5%	50.8%	9.1%	9.7%	14.1%

Source: U.S. Department of Commerce 2000. Data Set: Census 2000 Summary File 3 (SF 3) - Sample Data.

Figure 3.19-9 HGLA Census Block Groups (within six miles)



Low Income Status

The Environmental Justice analysis also addressed the low-income populations living in the two Census Block Groups within six miles of the HGLA. This analysis focused on Census 2000 data regarding the number of persons living below the “poverty threshold” in 1999, and added consideration of those under 150% of the poverty threshold.

The Census Bureau determines the poverty threshold, which represents a federal government estimate of the point below which a household of a given size has cash income insufficient to meet minimal food and other basic needs. It is set at a national level and does not vary by the region, only by the age of the householder and size of the household. It is adjusted each year using the Consumer Price Index. If a family’s total income is less than the family’s threshold, then that family and every individual in it is considered in poverty. The official poverty definition uses money income before taxes, and does not include capital gains or noncash benefits (such as public housing, Medicaid, and food stamps). The poverty rate used to classify tracts is based on calculations for people in the “poverty universe.” The poverty universe, when using data from Census 2000, includes all United States residents except the institutionalized population, people in military group quarters and college dormitories, and unrelated individuals under 15 years of age.

CHAPTER 4

ENVIRONMENTAL

CONSEQUENCES

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CHAPTER 4 ENVIRONMENTAL CONSEQUENCES

4.1 INTRODUCTION AND OVERVIEW

This chapter analyzes the direct, indirect, cumulative and residual environmental consequences or impacts that could occur, or that are reasonably foreseeable, as a result of implementing each of the alternatives described in Chapter 2. The impact analyses are based on the assumptions and parameters detailed in the Reasonably Foreseeable Development (RFD) Scenario identified for the Haiwee Geothermal Leasing Area (HGLA) by the Bureau of Land Management (BLM) and presented in Chapter 2. Current and previous environmental, land use, and socioeconomic conditions in and around the proposed HGLA, as described in Chapter 3, served as the baseline for assessing the potential direct, indirect, cumulative and residual impacts anticipated from the RFD scenario to the individual resources of the HGLA.

Throughout this EIS process, and particularly in its impact assessments, the BLM has focused on the applicable management guidelines presented in the CDCA Plan, the WEMO Plan, and other directly applicable land planning documents. As such, the projected and potential impacts associated with implementation of the alternatives have been rated against the applicable CDCA Plan and WEMO Plan management guidelines where applicable. Moreover, virtually all public lands within the CDCA under BLM management have been designated geographically into four multiple-use classes based on the sensitivity of resources and kinds of uses for each geographic area. The HGLA falls within Multiple-Use Class L: Limited Use. Multiple-Use Class L is managed to protect sensitive natural, scenic, ecological, and cultural resource values. Public lands designated as Class L are managed to provide for generally lower intensity, carefully controlled, multiple use of resources while ensuring that sensitive values are not significantly devalued. The specific land use and management guidelines for each resource are included under each land use and resource discussion.

4.1.1 Impact Analysis Methodology

The impact assessment that follows focuses on the general impacts that could occur as a result of implementing each of the HGLA alternatives. The methodology for this assessment conforms with the guidance found in the following sections of the Council on Environmental Quality (CEQ) regulations for implementing the National Environmental Policy Act (NEPA): 40 CFR 1502.24 (Methodology and Scientific Accuracy); 40 CFR 1508.7 (Cumulative Impact); and 40 CFR 1508.8 (Effects).

CEQ regulations require that agencies “rigorously explore and objectively evaluate” the impacts of the alternatives to a proposed action. Three of the action alternatives in this Environmental Impact Statement (EIS) propose making part or all of the HGLA open and available for leasing of geothermal resources. Since there are no project-and site-specific exploration, development, and operational impacts, it is difficult to quantify specific, direct impacts of the Haiwee RFD scenario on locations or specific resources. For this reason, the following impact analyses and projections rely, to a certain degree, on observed impacts recorded at other, comparable geothermal energy development projects.

Neither the proposed CDCA Plan amendment nor issuance of the three pending lease applications will authorize any construction or development of any specific geothermal resources or facilities within the HGLA. A number of direct, on-the-ground impacts would likely result from implementation of the Haiwee RFD scenario and the development of geothermal resources within the HGLA. Geothermal exploration, development, operations, and any associated impacts, however, would not occur until the BLM further specifically approves those activities through additional NEPA analysis. The potential impacts of amending the CDCA Plan and authorizing leases within the HGLA are indirect. According to the CEQ regulations, indirect impacts “are caused by the action [leasing] and are later in time or farther removed in distance, but are reasonably foreseeable” (40 CFR 1508(b)). The following impact analyses address indirect impacts.

In addition to these foreseeable impacts from implementation of the RFD scenario, leasing of the federal geothermal resources could have other indirect impacts. For example, approval for BLM leasing in the HGLA may cause developers (lessees) to acquire surface use and mineral rights to adjacent, non-BLM lands for economic and/or technical reasons. The RFD scenario assumes that some degree of development would occur on non-federal as well as on BLM-administered lands. Another result might be an influx of residents onto nearby non-federal lands. Indirect impacts to non-federal lands from activities occurring on BLM-administered lands could thus include additional impacts to a variety of resources and land uses.

4.1.2 Terminology Used

Specific terms referring to the intensity, scope (geographic extent), and duration of impacts are used in this chapter. It should also be noted that impacts are not necessarily negative; some of the program-induced impacts represent positive benefits (e.g., employment, tax revenue for the local governments), and are identified as such. The following terminology is used in the impacts analysis:

Adverse: The effect is negative to a particular resource or a number of resources.

Beneficial: The effect is positive to a particular resource or a number of resources.

Negligible: The effect is at the low level of detection; change would be difficult to measure.

Minor: The effect of an impact is slight but detectable; there would be a small change to existing conditions.

Moderate: The effect is readily apparent; there would be a measurable change that could result in small, but permanent change.

Major: The effect is large; there would be a highly noticeable, long-term, or permanent measurable change.

Localized: The effect occurs at a specific site or within a known boundary.

Short-term: The effect occurs only for a short time after implementation of an action. For example, construction of an exploration well would remove vegetation from the area. After the well is drilled and exploration is completed, the area would be reclaimed with native vegetation. As such, the area is expected to be revegetated within a relatively short time. Construction traffic or noise impacts from drilling rigs would also be considered short-term.

Long-term: The effect occurs for an extended period after implementation of an action. Loss of vegetation from site preparation and construction, and the subsequent presence of the geothermal facilities and associated infra-structure, would be considered a long-term impact, since they would presumably last for the life of the geothermal facility.

4.1.3 Incomplete or Unavailable Information

Impacts to the various environmental, social, and land use resources of the HGLA and surrounding lands are quantified where possible. In the absence of quantitative data, impacts are described based on the professional judgment of the interdisciplinary team of technical specialists using the best available information. This chapter identifies explicitly all impact projections based on incomplete information or best professional judgment.

4.1.4 Mitigation

Mitigation measures designed to reduce or avoid impacts are identified in Appendix A of this document as best management practices (BMPs); they will be applied by the Authorized Officer to the action alternatives, as appropriate. With any proposed project requiring additional authorization, site- and project-specific mitigation measures and stipulations may become part of that approval. Such measures are often based on the conditions at a specific location and on the characteristics of a specific proposed project. Therefore, mitigation measures and stipulations, in addition to those described in Chapter 2, may be developed and applied as needed.

4.1.5 Assumptions

Several general assumptions underlie the analysis of potential impacts of BLM's proposed actions. The following assumptions are common to all resources. Assumptions specific to a particular resource are listed under that resource's impact discussion:

- Operation of geothermal projects in the HGLA would last at least 30 years;
- Exploration would last six to 18 months;
- Drilling would last 90-150 days per well; and
- Geothermal plant construction would take four months.
- All action alternatives that authorize geothermal leasing will result in development activities outlined in the RFD as a maximum development scenario.
- The No Action Alternative would result in no reasonably foreseeable geothermal exploration or development.

4.1.6 Chapter Format

The following impact assessments are presented by resource. In turn, each resource's impact assessment section is divided into four subsections:

- Applicable management goals from approved land-use plans or other policy directives;
- Impact criteria relating to the assessment of the degree of impact;

- General impacts typically associated with geothermal energy development activities; and
- Anticipated and foreseeable impacts by alternative.

In accordance with the CEQ regulations and BLM's NEPA handbook (H-1790-1), Chapter 4 concludes with the following sections:

- Cumulative Impacts (Section 4.21)
- Irreversible or Irretrievable Impacts (Section 4.22)
- Short-term Use versus Long-Term Productivity of the Environment (Section 4.23)
- Residual Impacts (Section 4.24)

4.2 AIR QUALITY

4.2.1 Methodology

4.2.1.1 Management Goals

The California Desert Conservation Area (CDCA) Plan provides the following management direction for air quality protection in the CDCA, including the HGLA.

These areas will be managed to protect their air quality and visibility in accordance with Class II objectives of Part C of the Clean Air Act Amendments, unless otherwise designated another class by the State of California as a result of recommendations developed by any BLM air quality management plan. These Class II objectives include, among others, attainment and maintenance of the ambient air quality standards and protection of visibility within the CDCA.

4.2.1.2 Impact Criteria

The potential for air quality impacts resulting from any future geothermal exploration or developments in the HGLA is assessed with respect to three criteria. Significant impacts on air quality could occur if any of the following were to take place:

- Reasonably foreseeable future actions conflict with or obstruct implementation of the applicable air quality attainment plan;

- Reasonably foreseeable future actions violate any stationary source air quality standard or contribute to an existing or projected air quality violation; or
- Reasonably foreseeable future actions expose sensitive receptors (e.g., concentrations of children, the elderly, or persons with respiratory conditions) to major pollutant concentrations.

In addition to air quality impacts, significant impacts to global climate could occur if the following was to take place:

- Reasonably foreseeable future actions conflict with the provisions of Administrative Bill (AB) 32, the California Global Warming Solutions Act.

The analysis of indirect air quality impacts from exploration, development, production, or decommissioning activities uses a high-to-low scale of risks. The following definitions are used in assessing the potential risk of future indirect impacts from geothermal exploration and development:

High

The risk of potential indirect impacts would be high if significant impacts to the above criteria occurred during exploration, development, production, closure, or restoration. Impacts would be considered high if emissions are above *de minimis* levels, and/or an evaluation demonstrated that the emissions from the project would cause an exceedance of an air quality standard;

Medium

The risk of potential indirect impacts would be medium if moderate impacts to the above criteria occurred during exploration, development, production, closure, or restoration. Impacts would be considered medium if emissions are above *de minimis* or other significance thresholds, but further evaluation or mitigation measures would ensure that no exceedance of an air quality standard would occur (for example, through detailed modeling, or through obtaining offsets); and

Low

The risk of potential indirect impacts would be low if minor or no impacts to the above criteria occurred during exploration, development, production, closure, or restoration. Impacts would be considered low if emissions are below *de minimis* or other significance thresholds, and would not cause an exceedance of an air quality standard.

Clean Air Act Conformity

The General Conformity Rule is a statutory obligation under Section 176(c)(4) of the 1990 Clean Air Act Amendments, as set forth by Congress. Section 176 authorizes the U.S. Environmental Protection Agency (USEPA) and the states to regulate federal actions to a greater extent than they regulate private activities. The General Conformity Rule applies to federal actions in federal nonattainment or maintenance areas. A federal action is defined as any activity engaged in by a department, agency, or instrumentality of the federal government, or any activity that a department, agency, or instrumentality of the federal government supports in any way, provides financial assistance for, licenses, permits, or approves, other than activities related to transportation plans, programs, and projects. All federal actions must demonstrate that they conform to the applicable State Implementation Plan for the nonattainment area. It is the responsibility of the federal agency to make the determination that the federal action will conform to the State Implementation Plan.

Under the General Conformity Rule, the federal agency makes conformity determinations on a case-by-case basis. However, in an effort to limit time and resources invested by agencies in making determinations for thousands of federal actions annually, the USEPA included *de minimis* levels in the rule to serve as cutoff points to focus on those federal actions likely to have the most significant impacts on air quality. These *de minimis* levels are based on the nonattainment classification of the area in which the federal action is proposed. Federal actions with emissions below the applicable *de minimis* levels are exempt from making a conformity determination under the General Conformity Rule. Table 4.2-1 presents *de minimis* levels based on nonattainment status.

In addition to evaluating whether emissions associated with a federal action are below the *de minimis* levels, a determination must be made to evaluate whether the emissions from a federal action are regionally significant. “Regionally significant” is defined as emissions that are 10 percent of a total nonattainment area’s emission inventory for the nonattainment pollutant (or precursor pollutant). If a federal action’s emissions are below the *de minimis* levels, and if the emissions are not regionally significant, the project is exempt from the General Conformity Rule.

In evaluating emissions from a federal action, the following emissions must be included:

- Construction or operational emissions of any air emission source not covered under a New Source Review or Prevention of Significant Deterioration permit or a hazardous waste remediation action.
- Construction, renovation, or demolition of buildings or facilities.

Table 4.2-1 *De minimis* Levels for Exemption from Conformity Determination under the General Conformity Rule

Pollutant	<i>De minimis</i> Threshold, tons/year
Ozone (Precursor Emissions VOCs or NO _x)	
Serious nonattainment areas	50
Severe nonattainment areas	25
Extreme nonattainment areas	10
VOCs	100
NO _x	100
Marginal and Moderate nonattainment and ozone maintenance areas inside an ozone transport region	
VOCs	50
NO _x	100
All nonattainment and maintenance areas	100
Sulfur Dioxide or Nitrogen Dioxide	
All nonattainment and maintenance areas	100
Moderate nonattainment and maintenance areas	100
Serious nonattainment areas	70
PM _{2.5}	
Direct emissions	100
SO ₂	100
NO _x (unless determined not to be a significant precursor)	100
All nonattainment and maintenance areas	25

Source: 40 CFR Part 51

Key: VOCs = volatile organic compounds; NO_x = oxides of nitrogen; PM₁₀ = particulate matter with an aerodynamic diameter less than 10 microns; PM_{2.5} = particulate matter with an aerodynamic diameter less than 2.5 microns; SO₂ = sulfur dioxide

As discussed in Section 3.1, the HGLA is located in Inyo County, California, which is part of the Great Basin Valleys Air Basin. The Great Basin Valleys Air Basin is considered an unclassified/attainment area for the National Ambient Air Quality Standards (NAAQS) for ozone (O₃), carbon monoxide (CO), nitrogen dioxide (NO₂), fine particulate matter less than or equal to 2.5 microns in diameter (PM_{2.5}), and sulfur dioxide (SO₂). In the HGLA, the Owens Valley is classified as a serious nonattainment area under the NAAQS for suspended

particulate matter less than or equal to 10 microns in diameter (PM_{10}), and the Coso Junction area is classified as an attainment/maintenance area under the NAAQS for PM_{10} . The GBUAPCD Governing Board adopted its *PM10 Maintenance Plan and Redesignation Request for the Coso Junction Planning Area* on May 17, 2010. This plan has been approved by CARB and the USEPA. Under this Plan, the Coso Junction area is designated as a maintenance area for PM_{10} . A conformity review would therefore be required for PM_{10} at the implementation stage of the program since it is designated as a maintenance area. In addition to concerns regarding PM_{10} , hydrogen sulfide (H_2S) is monitored within the HGLA region because it is present at the Coso Geothermal area. The GBUAPCD operates monitoring stations at Coso Junction and at the gate of the Coso Geothermal Plant to monitor concentrations of H_2S . In addition, the Coso Geothermal Plant is required to monitor ambient concentrations of H_2S within its property boundary. As a condition of its permit to operate, Coso Geothermal is required to report concentrations measured at its on-site monitors to the GBUAPCD and, should levels exceed eight parts per billion (ppb) at any single monitor, Coso Geothermal is required to shut down its operations to reduce H_2S emissions and concentrations. The Coso geothermal plant currently operates a scrubber to remove sulfur from its emissions. Any geothermal plant that would be permitted by the GBUAPCD within the HGLA would likely be subject to similar permit conditions to requiring it to monitor and, if necessary, mitigate its H_2S emissions.

4.2.2 Direct/Indirect Impacts

4.2.2.1 General Impacts

Criteria and Other Pollutants

The visible plumes commonly seen rising from some geothermal power plants are water vapor emissions (steam) from flash or steam-type geothermal plants. The RFD scenario estimates that up to two dual flash geothermal plants could be operating in the HGLA; therefore, steam plumes are potentially visible from the two locations. Because geothermal plants do not burn fuel like fossil fuel plants, they release comparatively low levels of air emissions during operations.

The following pollutants are generally associated with geothermal plants:

Hydrogen Sulfide (H_2S)

H_2S remains the pollutant generally considered to be of greatest concern for the geothermal community. H_2S can be emitted during well flow testing in the development phase of the geothermal plants, as well as in non-condensable gases released from a conventional (i.e., wet) cooling tower.

Oxides of Nitrogen (NO_x)

Because geothermal plants do not burn fossil fuel, they do not emit NO_x from energy production. Diesel fuels from drill rigs and trucks, as well as combustion emissions from construction equipment, vehicles, and occasional operation of emergency diesel generators would be a source of NO_x during drilling and construction activities. However, in some cases where H₂S is present and combusted, negligible amounts of NO_x are also produced.

Sulfur Dioxide (SO₂)

SO₂ forms when fuel containing sulfur is combusted at geothermal plants. While geothermal plants do not emit SO₂ directly, once H₂S is released as a gas into the atmosphere it spreads into the air and eventually changes into SO₂ and sulfuric acid. Therefore, any SO₂ emissions associated with geothermal energy would be derived from the minor amounts of H₂S emissions.

PM₁₀ and PM_{2.5}

PM₁₀ and PM_{2.5} are emitted throughout the various stages of fossil fuel-fired electric power generation, particularly coal mining. Although coal and oil plants produce large amounts of PM₁₀ and PM_{2.5}, geothermal plants emit almost none. Water-cooled geothermal plants emit only small amounts of PM₁₀ and PM_{2.5} from the cooling tower when steam condensate evaporates as part of the cooling cycle.

Carbon Dioxide (CO₂)

CO₂ is a colorless, odorless gas that is released into the atmosphere as a byproduct of burning fossil fuels as well as respiration by living organisms. Geothermal plants emit small quantities of CO₂ compared to fossil fuel-fired plants. Some geothermal reservoir fluids contain varying amounts of certain non-condensable gases, including CO₂. Geothermal steam is generally condensed after passing through the turbine. The amount of CO₂ found in geothermal fluid can vary depending on location, and the specific amount of CO₂ actually released into the atmosphere can vary depending on plant design.

Mercury

Mercury occurs naturally in soils, groundwater, and surface waters, but human activity can release additional mercury into the air, water, and soil. Mercury is not present in every geothermal resource and is not an issue at the nearby Coso geothermal facility; however, if mercury is present in the Haiwee geothermal resource used for power production, mercury emissions could result depending on the technology used.

Volatile Organic Compounds (VOCs)

Geothermal plants may emit naturally occurring hydrocarbons, such as methane. Methane is the primary VOC emitted by geothermal plants, followed by ethane and propane. The USEPA's inventory of methane emission from electric plants does not include geothermal plants, because the amounts of methane emissions from geothermal resources are generally insignificant.

Other Reactive Organic Gases (ROG)

ROGs such as benzene could be released into the atmosphere from flash geothermal plants. The amount of ROGs that could be released into the atmosphere depends on the characteristics of a particular geothermal resource. Benzene and other ROGs are regulated as toxic air contaminants by the State of California and, if released in sufficient quantities, are subject to permit conditions that could require controls on flashed gases.

Ammonia

Naturally occurring ammonia is emitted by geothermal facilities. Geothermal energy production accounts for only a fraction of total ammonia emissions in the United States – substantially less than one percent; therefore, the impacts to air quality are negligible.

Arsenic

Dust derived from the Owens Valley (and including Rose Valley) is rich in As, Ba, and Sb that are deposited downwind. Ground disturbance and dust generation in the project area may present air quality problems in the short term for on-site workers and cumulatively add to the already enriched dust load blowing down the Owens Valley toward the communities along Highway 395 and into Ridgecrest. Arsenic concentrations in dust are much higher than in soils and sediments.

As a result, geothermal plants typically emit in a regional emissions budget only trace amounts of NO_x, almost no SO₂, and small amounts of CO₂. The primary pollutant that a minority of geothermal plants must abate is H₂S, which is naturally present in many volcanic geothermal reservoirs. With the use of advanced abatement equipment, however, emissions of H₂S are regularly maintained below applicable California standards.

Other than the use of standby emergency generators, fossil fuel combustion does not occur in the production of electricity at geothermal facilities.

4.2.2.2 Air Emissions Estimates

As discussed earlier, the USEPA has determined specific federal actions, or portions thereof, to be exempt from a formal conformity determination. Actions are exempt where the total

net increase of all reasonably foreseeable direct and indirect emissions (1) would be less than specified emission rate thresholds, known as *de minimis* limits, and (2) would be less than 10 percent of the area's annual emission budget. Therefore, total annual emissions resulting from future project construction would be calculated to determine whether a project is exempt and therefore would have no impacts.

Emissions associated with geothermal exploration and development include surface disturbance (fugitive dust), heavy equipment exhaust, emissions from the drill rigs (which are assumed to meet Tier 3 standards, at a minimum), and employee and construction vehicles. Emissions from heavy equipment used in the construction of the geothermal plant were estimated based on emission factors for the South Coast Air Basin (SCAB) from the California Air Resources Board's (CARB) OFFROAD2007 Model (ARB 2007a), as published on the South Coast Air Quality Management District's (SCAQMD's) website. Emission factors for 2012 represent the average fleet emissions throughout the SCAB, and are considered representative of construction equipment that would be in use during construction of any future projects in the HGLA. Emissions from worker travel and truck traffic were calculated using the CARB's EMFAC2007 Model (ARB 2007b), which is available from the CARB, for on-road vehicles. Emissions of fugitive dust were estimated based on SCAQMD and USEPA emission factors.

To calculate emissions associated with geothermal plant development as outlined in the RFD, it was assumed that emissions would be associated with the following phases. These phases are assumed to be identical for all action alternatives (Alternatives A, C, and D).

Exploration

Exploration will include geophysical exploration such as seismic testing and the drilling of 20 temperature gradient wells. The total surface disturbance anticipated for exploration is 62 acres.

New Production Well Development

To support 30 megawatts (MW) of net geothermal generation, it is estimated that a total of 15 production wells and seven injection wells will need to be drilled over the course of the estimated 30-year useful life of each geothermal plant. It is assumed that initial development will involve drilling nine production wells and three injection wells. It is anticipated that one new well will be drilled every three years. It is anticipated that the total surface disturbance for two well fields (for two 30-MW geothermal plants) will be 202 acres.

Geothermal Plant Construction

Each of the two plant facilities would require about 20 acres, resulting in 25 acres of total

surface disturbance including cut and fill requirements. Each plant would also require three miles of access road and four miles of new transmission line to intertie with an existing transmission line that runs through the southwest portion of the HGLA. As a result, the total disturbed acreage for the two geothermal plants is anticipated to be 120 acres.

Table 4.2-2 presents a summary of the construction emission estimates for the development of two 30-MW geothermal plants within the HGLA. Appendix F provides detailed descriptions of the emission assumptions and calculations. Estimates for building area and total disturbed area were based on data provided in Chapter 2 and Appendix F of this document.

The total annual emissions that are expected to result from construction activities within each phase of the RFD scenario are estimated as follows: Annual PM₁₀ emissions are estimated to increase by 0.61 tons during exploration activities, by 2.56 tons per year during well field development activities, and by 1.22 tons per year during geothermal plant construction.

Table 4.2-2 Estimated Criteria Emissions from Construction in the HGLA

Emission Source	ROG	NOx	CO	SOx	PM₁₀	PM_{2.5}
<i>Total Emissions, lbs/day</i>						
Exploration						
Fugitive Dust	-	-	-	-	48.36	10.16
Drill Rig Emissions	2.98	56.55	51.59	24.74	2.98	2.95
Off-Road Diesel	7.43	31.53	57.20	0.07	3.23	2.87
Construction Truck Trips	0.24	6.14	1.65	0.01	7.25	0.68
Worker Trips	0.47	0.86	7.91	0.01	0.14	0.05
TOTAL	11.12	95.08	118.35	24.83	61.96	16.71
Wellfield Development						
Fugitive Dust	-	-	-	-	157.56	33.09
Drill Rig Emissions	2.98	56.55	51.59	24.74	2.98	2.95
Off-Road Diesel	7.43	31.53	57.20	0.07	3.23	2.87
Construction Truck Trips	0.84	22.16	5.90	0.05	27.49	6.34
Worker Trips	11.04	20.85	188.84	0.13	2.78	1.00
TOTAL	22.29	131.09	303.53	24.99	194.04	46.25
Geothermal Plant Construction						
Fugitive Dust	-	-	-	-	93.6	19.66
Off-Road Diesel	11.32	45.44	88.60	0.10	4.88	4.35
Construction Truck Trips	0.49	12.28	3.29	0.03	14.49	3.36
Worker Trips	11.04	20.85	188.84	0.13	2.78	1.00
TOTAL	22.85	78.57	280.73	0.26	115.75	28.37

<i>Total Construction Emissions, tons/year</i>						
Exploration						
Fugitive Dust	-	-	-	-	0.24	0.05
Drill Rig Emissions	0.15	2.83	2.58	1.24	0.15	0.15
Off-Road Diesel	0.67	2.84	5.15	0.01	0.29	0.26
Construction Truck Trips	0.02	0.55	0.15	0.00	0.65	0.15
Worker Trips	0.04	0.08	0.71	0.00	0.02	0.00
TOTAL	0.88	6.30	8.59	1.25	1.35	0.61
Wellfield Development						
Fugitive Dust	-	-	-	-	0.79	0.17
Drill Rig Emissions	1.07	20.36	18.57	8.91	1.07	1.06
Off-Road Diesel	0.93	3.94	7.15	0.01	0.40	0.36
Construction Truck Trips	0.11	2.99	0.80	0.01	3.71	0.85
Worker Trips	1.38	2.61	23.60	0.02	0.35	0.12
TOTAL	3.49	29.90	50.12	8.95	6.32	2.56
Geothermal Plant Construction						
Fugitive Dust	-	-	-	-	0.47	0.10
Off-Road Diesel	1.41	5.68	11.08	0.01	0.61	0.54
Construction Truck Trips	0.07	1.66	0.44	0.00	1.96	0.46
Worker Trips	1.38	2.61	23.60	0.02	0.35	0.12
TOTAL	2.86	9.95	35.12	0.03	3.39	1.22

Pollutants emitted during the drilling phase also include emissions of non-condensable gases (H₂S, ammonia, metals, and hydrocarbons) from well flow testing. Current knowledge of the groundwater quality and of the locations of future well locations makes accurate predictions impossible for emissions from HGLA well flow testing. However, to provide a reasonable emissions estimate for the Haiwee RFD scenario, the projected emissions relied on the known emissions recorded during well flow testing for the Salton Sea Geothermal Unit #6 (California Energy Commission (CEC) 2002). Based on that example, and assuming that the initial phase of drilling would involve drilling and testing of nine production wells (assuming each production well would be tested for 96 hours) and of three injection wells (assuming each injection well would be tested for 24 hours), emissions for the Haiwee RFD scenario are estimated in Table 4.2-3.

Table 4.2-3 Potential HGLA Well Flow Testing Emissions

Pollutant	Production Single Well (lbs/hr)	Production 9 Wells (lbs total)	Injection Single Well (lbs/hr)	Injection 3 Wells (lbs total)	Initial Development Total 12 Wells (lbs)
PM ₁₀	96.8	83635	56	4032	87667
H ₂ S	17.7	15293	14.7	1058.4	16351
Ammonia	70.8	61171	59.0	4248	65419
Arsenic	4.43E-03		2.58E-03		
PM		3.83		0.18576	4.02
Arsenic	1.87E-03		1.56E-03		
HC		1.62		0.11232	1.73
Benzene	0.330	285.12	0.275	19.8	304.92
Beryllium	4.10E-06	0.0035	2.39E-06	0.000172	0.0037
Boron	0.131	113.18	7.64E-02	5.5008	118.68
Cadmium	5.14E-04	0.44	2.99E-04	0.021528	0.46
Chromium	1.23E-06	0.0011	7.18E-07	5.17E-05	0.0012
Copper	1.64E-03	1.42	9.55E-04	0.06876	1.49
Ethylbenzene	1.94E-04	0.17	1.62E-04	0.011664	0.18
Lead	0.033	28.51	0.019	1.368	29.88
Manganese	4.10E-01	354.24	0.24	17.28	371.52
Mercury	3.52E-05	0.030	4.11E-05	0.002959	0.033
Nickel	8.24E-06	0.0071	4.80E-06	0.000346	0.0074
Selenium	2.04E-06	0.0018	1.19E-06	8.57E-05	0.0019
Toluene	4.54E-03	3.92	3.78E-03	0.27216	4.19
Xylenes	5.56E-04	0.48	4.63E-04	0.033336	0.51
Zinc	0.134	115.78	0.078	5.616	121.40

Radon Emissions					
	Production Single Well (Ci/hr)	Production 9 Wells (Ci total)	Injection Single Well (Ci/hr)	Injection 3 Wells (Ci total)	Total 12 Wells (Ci/year)
Radon	1.35E-03	1.17	1.13E-03	0.08	1.25

If necessary, technology is available to control emissions of H₂S and other non-condensable gases associated with well testing by injecting hydrogen peroxide or other fluids .

Emissions Estimate for Geothermal Plant Operations

Vehicle emissions from employee and delivery vehicles, as well as emissions from the cooling towers, would be the primary sources of pollutants during geothermal plant operation.

The cooling towers are the primary source of air emissions at geothermal plants when using conventional (i.e., wet) cooling towers during normal operations. Such emissions include the non-condensable gases (NCGs), off-gassing releases from the condensate, and particulate matter (PM₁₀ and PM_{2.5}). NCGs, which flow from the flashing steam of the brine, collect in the condenser of the turbine generator along with the condensate, where NCGs would be separated.

To control emissions of NCGs, NCGs can be vented to a system designed to remove these gases from the steam. NCGs can either be vented to a control system (such as a LO-CAT system or “Stretford” system), or be controlled via use of an iron chelate. This control system would remove the H₂S. However, in general, control systems for NCGs would also reduce emissions of other NCGs or volatized elements.

The amount of particulate matter would depend on the total dissolved solids present in the cooling tower brine. At this time, information is not available about NCG emissions or particulate matter from each cooling tower at the two geothermal plants. For comparison, the Salton Sea Unit 6 project estimated the following emissions for its cooling tower:

Table 4.2-4 Estimated Cooling Tower Emissions Salton - Sea Unit 6

Operational Source (lbs/hr)	VOC	PM₁₀	NH₃	H₂S
Cooling tower – NCG	0.375	-	0.12	0.766
Cooling tower – Off gassing	-	-	712	3.374
Cooling tower – Drift	-	2.91	0.0008	-
(tons/year)				
Cooling tower – NCG	1.64	-	0.526	3.36
Cooling tower – Off gassing	-	-	2,681	14.78
Cooling tower – Drift	-	12.74	0.0035	-

Drift eliminators can control emissions from wet cooling towers. For the HGLA estimates, installation of the drift eliminators was assumed so that drift rate would not exceed 0.0005 percent.

Emissions from employee and delivery vehicles are estimated in Table 4.2-5. Appendix F provides details on the emission assumptions and calculations.

Table 4.2-5 Estimated Vehicle Emissions HGLA Geothermal Plant

Emission Source	ROG	NO_x	CO	SO_x	PM₁₀	PM_{2.5}
<i>Total Vehicle Emissions, lbs/day</i>						
Employee/Delivery Vehicles	3.93	7.27	66.83	0.05	1.17	0.41
<i>Total Vehicle Emissions, tons/year</i>						
Employee/Delivery Vehicles	0.49	0.91	8.35	0.01	0.14	0.05

The specific future emissions from the plants themselves will be accounted for in the construction/operating permit applications for review by the GBUAPCD.

As discussed above, the GBUAPCD would likely include a condition in the operating permit that requires monitoring for H₂S in the vicinity of an operating geothermal plant. As discussed in Chapter 3, the GBUAPCD currently operates monitoring stations at Coso Junction and at the gate of the Coso Geothermal Plant to monitor concentrations of H₂S. As a condition of its permit to operate, the Coso Geothermal Plant is required to monitor

ambient concentrations of H₂S within its property boundary, and is required to report concentrations measured at its on-site monitors to the GBUAPCD. Another condition of its permit to operate is that Coso Geothermal is required to shut down its operations in the event that H₂S levels exceed eight ppb at any single monitor. Any geothermal plant that would be permitted by the GBUAPCD within the HGLA is expected to be subject to similar permit conditions to monitor H₂S.

Conformity Review Determination

Since projected annual emissions of PM₁₀ under the Haiwee RFD scenario would not exceed the 100 tons per year *de minimis* threshold, either for construction or for operations, the development and operation of the two geothermal plants would be exempt from the General Conformity Rule, and would not require a conformity review.

Global Climate Change

According to the BLM Air Resource Management Program Manual, NEPA documents and Resource Management Plans (RMPs) should evaluate/address the role of climate and weather information in proposed actions and activities such as land use authorizations, smoke management, drought management, wilderness management, weeds management, mineral resource development, recreational uses, transportation management, and other resource management activities and decisions. Where appropriate and geographically applicable, managers should use other Federal and State agency climate and weather data.

Activities, programs, and projects initiated by the BLM and by operator-initiated activities and projects that the BLM authorizes, may affect and/or be affected by climate and climate change. Therefore, the BLM considers climate and potential or documented climate change integral to its planning and decision making process for renewable and non-renewable resource management. When conducting long-range planning, and when making major decisions pursuant to Secretarial Order 3226, the BLM evaluates:

- 1) how resources may be affected by climate change;
- 2) how to adapt land management practices due to the influence of climate change on biological and physical resources, and
- 3) how BLM land management practices may or may not contribute to the potential effects of climate change, including but not limited to emissions, sequestration, or mitigation of greenhouse gases.

This section therefore addresses how the RFD scenario in the HGLA would affect global climate.

According to the CEC (CEC 2006), CO₂ accounts for 84 percent of statewide greenhouse gas (GHG) emissions, with methane accounting for 5.7 percent and nitrous oxide for 6.8 percent of greenhouse gas emissions, respectively. Other pollutants account for the remaining percentage of GHG emissions in California. The transportation sector is the single largest source of California’s greenhouse gas emissions, accounting for 41 percent of emissions statewide. In 2004, California produced 431 million metric tons of total carbon dioxide-equivalent emissions (not including energy imports).

The main source of greenhouse gas emissions from the HGLA would be combustion of fossil fuels during construction activities. Emissions of such GHGs were calculated using the same approach as the previous emission calculations provided for overall construction emissions. Table 4.2-6 summarizes the estimated emissions of GHGs. The corresponding emission calculations are provided in Appendix F.

Table 4.2-6 HGLA Construction Greenhouse Gas Emissions Estimates*

	CO₂	CH₄	N₂O
Exploration	651	0.06	0.50
Wellfield Development	2,726	0.49	1.10
Geothermal Plant Construction	2,816	0.27	1.32
TOTAL	6,192	0.82	2.92
Global Warming Potential	1	21	310
CO ₂ Equivalent	6,192	17	905
CO₂ Equivalent Total	7,114		

*Emissions in metric tons per year

The SCAQMD recommends that construction emissions be amortized over a 30-year period to account for the program’s contribution to overall GHG emissions. If amortized over a 30-year period, construction would contribute 237 metric tons per year of CO₂. The amortized CO₂ emissions of 237 metric tons are well below the CARB’s proposed threshold of 7,000 metric tons per year required for reporting of GHG emissions and, in addition, would be temporary. This level of GHG emissions would not result in a significant impact on global climate, and the Haiwee geothermal leasing program would therefore not conflict with the provisions of AB 32.

Emissions of GHGs during geothermal plant operation would be associated with routine maintenance and inspection activities, and would not differ from existing conditions.

Because such geothermal plants are a source of renewable energy, the program would not contribute to GHG emissions, but facilitate achieving renewable energy goals.

4.2.2.3 Impacts by Alternative

The BLM evaluated the anticipated and potential impacts to the air resources of the HGLA and surrounding areas under five alternative scenarios. Four of these alternatives represent action alternatives and require amending the current CDCA Plan. Three of these (Alternative A, C, and D) also open some or all of the HGLA for leasing and development of the HGLA's geothermal resources.

Alternative A – Open the Entire HGLA for Geothermal Exploration and Development; Amend the CDCA Plan to have the HGLA open and available for Geothermal Leasing; Authorize All Pending Lease Applications Within the HGLA

Under Alternative A the CDCA Plan would be amended to reflect the delineated HGLA as open to geothermal leasing for direct and indirect use, and 22,805 acres of BLM-administered lands or federal mineral estate would be made available for geothermal exploration, development, and utilization. Under this alternative the BLM would authorize the three pending non-competitive lease applications for 4,277 acres.

The foreseeable and potential air quality impacts associated with Alternative A are discussed in Section 4.2.2.2, above. Any future geothermal development project would be required to undergo permitting by the GBUAPCD, and to comply with all conditions of the air permit issued under that permitting process. For Class L, the CDCA Plan's Multiple-use Class L guidelines state that these areas will be managed to protect their air quality in accordance with Class II objectives of Part C of the Clean Air Act Amendments unless otherwise designated another class by the State of California as a result of recommendations developed by any BLM air-quality management plan. In addition, leases issued under Alternative A would be subject to other applicable laws, regulations, formal orders, and the terms and conditions of BLM's standard lease form. In the event that future site-specific permitting studies would identify sensitive resources that warrant protection or preservation, the BLM would stipulate appropriate, project-specific onsite mitigation measures.

The degree of impacts of Alternative A on the air quality of the HGLA and surrounding areas are considered low. In brief, the total annual emissions that are expected to result from construction activities within each phase of the RFD scenario are estimated as follows: Annual PM₁₀ emissions are estimated to increase by 0.61 tons during exploration activities, by 2.56 tons per year during well field development activities, and by 1.22 tons per year during geothermal plant construction. Emissions associated with well testing could be

controlled through injection of hydrogen peroxide or other fluids to control emissions of H₂S and other non-condensable gases from the wells.

Vehicle emissions from employee and delivery vehicles, as well as emissions from the cooling towers, would be the primary sources of pollutants during geothermal plant operation. The cooling towers are the primary source of air emissions when using wet cooling towers during normal operations. However, wet cooling towers are an unlikely option given the limitation of use of groundwater to compensate for evaporative losses in wet cooling towers. Moreover, as discussed above, technology exists to control emissions of non-condensable gases (NCGs), off-gassing releases from the condensate, and particulate matter (PM₁₀ and PM_{2.5}) from cooling tower drift.

Since projected annual emissions of PM₁₀ under the Haiwee RFD scenario would not exceed the 100 tons per year *de minimis* threshold, either for construction or for operations, the development and operation of the two geothermal plants would also be exempt from the General Conformity Rule, and would not require a conformity review. Finally, the anticipated level of GHG emissions would not result in a significant impact on global climate, and the Haiwee geothermal leasing program would therefore not conflict with the provisions of AB 32.

Alternative B – Close the Entire HGLA to Geothermal Exploration and Development; Amend the CDCA Plan to have the HGLA closed and unavailable for Geothermal Leasing; Deny All Pending Lease Applications Within the HGLA

Under Alternative B, BLM-administered lands located within the HGLA would be closed to geothermal leasing, and the CDCA Plan would be amended to reflect that decision. Under this alternative the BLM would not offer competitive geothermal leases on any of the 22,805 acres of BLM-administered lands or federal mineral estate within the HGLA, and would deny the three pending non-competitive lease applications.

Alternative B would not result in any air quality impacts because no geothermal development would occur within the HGLA.

Alternative C – Open the HGLA to Geothermal Exploration and Development with Restrictions of NO Surface Occupancy in Sensitive Areas; Amend the CDCA Plan to have the HGLA open and available for Geothermal Leasing; Authorize All Pending Lease Applications Within the HGLA (Preferred Alternative)

Under Alternative C, the CDCA Plan would be amended to reflect the delineated HGLA as open to geothermal leasing for direct and indirect use, but with specific acreages of the HGLA under restrictions of the No Surface Occupancy (NSO) stipulation NSO-HGLA-1. Under this alternative, the BLM would also authorize the three pending non-competitive lease applications for 4,277 acres.

The NSO stipulation for specific areas of Alternative C will not change the application of the RFD to the HGLA. As a result, the foreseeable and potential air quality impacts associated with Alternative C would be generally similar to those for Alternative A.

Alternative D – Selective Closure of Sensitive Resource Areas within the HGLA for Geothermal Exploration and Development; Amend the CDCA Plan to have the HGLA open and available for Geothermal Leasing; Authorize All Pending Lease Applications Within the HGLA

Under Alternative D, the BLM would close specific areas within the HGLA to geothermal leasing to protect sensitive resources while opening the remainder of the HGLA to leasing. Of the 22,805 acres of BLM managed lands or federal mineral estate within the HGLA, approximately 13,773 acres would be closed and the remaining acres would be open in this alternative. The CDCA Plan would be amended to reflect the specific areas that are open and closed to geothermal exploration, development, and utilization. Under Alternative D, the BLM would also authorize the three modified pending non-competitive lease applications for 4,277 acres.

The closure of specific areas, Alternative D will not change the application of the RFD to the HGLA. As a result, the foreseeable and potential air quality impacts associated with Alternative D would be generally similar to those for Alternatives A and C.

Alternative E –No Action

Under the No Action Alternative, the CDCA Plan would not be amended, and the existing plan decisions, stipulations, and allocations would not change as a direct result of this EIS process. The HGLA would remain under management of the current CDCA Plan, which does not identify the HGLA as open or closed to geothermal leasing, nor does it indicate the availability status of lands within the HGLA. The three pending lease applications would be denied.

Alternative E would not result in any air quality impacts because no geothermal development would occur within the HGLA under present CDCA Plan policies and guidelines.

4.3 NOISE

4.3.1.1 Methodology

4.3.1.2 Management Goals

The CDCA Plan does not have any specific formal management goals for noise.

4.3.1.3 Impact Criteria

An action could have a significant noise effect if it would generate new sources of substantial noise, increase the intensity or duration of existing noise levels to sensitive receptors, or result in exposure of more people to high noise levels (BLM 2007).

4.3.2 Direct/Indirect Impacts

4.3.2.1 General Impacts

Given the location of existing, potentially sensitive noise receptors, construction noise from geothermal exploration and development activities, would not be expected to expose potentially noise-sensitive land uses to continuous noise sources louder than the existing sources such as off-highway vehicles. Noise would be generated by construction and well-drilling equipment during exploration and development and, at a lower level, during the subsequent operation of geothermal facilities. The principal noise sources during construction would be construction equipment and vehicles that would access the geothermal well and geothermal plant sites.

Construction Activities

Noise can be a potential concern during the temporary exploration drilling and geothermal plant construction phases. Construction equipment noise levels vary widely with the type of equipment used, and with the activity level or duty cycle (typical range is 45 to 120 A-weighted decibels [dB(A)]). In a typical construction project, the loudest short-term noise levels last only for a few minutes during each cycle. They typically occur during site preparation and grading from earth-moving equipment under full load (typically up to a maximum of 90 dB(A) at a distance of 50 feet from the source).

Construction equipment noise is usually considered to be a point source, with attenuation occurring within short distances at a rate of six dB(A) per doubling of distance (e.g., a noise level of 90 dB(A) at 50 feet will be 84 dB(A) at 100 feet, 78 dB(A) at 200 feet, and 72 dB(A) at 400 feet)).

Geothermal Plant

The nature of construction projects, with equipment moving from one point to another, work breaks, and idle time, is such that long-term noise averages are less than short-term noise levels. Heavy truck traffic at construction sites is generally fairly evenly distributed during

the working day, while light vehicles related to the work force arrive and typically leave the site only once per day. Moreover, other than the development of the supply and injection wells, no significant construction is expected to occur during night times with the exception of occasional machinery deliveries. As such, noise from traffic related to the proposed geothermal development is not expected to have any long-term, adverse effects on the local communities or the recreational activities in the area. For analysis of the proposed action, a maximum one hour average noise level of 80 dB(A) at a distance of 50 feet from the construction area was assumed for the site preparation phase.

Well Pad Construction

Well pad construction and well drilling, as well as construction of the proposed geothermal power plants and ancillary facilities will require heavy equipment operations for grading, filling, compacting, and paving. After initial site preparation, noise would be generated by other diesel engine- and gas engine-driven well-boring equipment, and by normal construction activities such as the use of power saws, drills, and hammers. Based on the projected construction activities, noise levels would average 60 to 70 dB(A) equivalent, average sound level (L_{eq})¹⁰ at a distance of 50 feet.

Noise will also be generated from well drilling and testing equipment and would last approximately 200 days for each well drilled, and up to one day for each drill rig assisted flow test. Generally, the noisiest phase of geothermal drilling operations occurs when drilling with compressed air. Noise may also be generated by release of steam during drilling and for pressure relief. During brief well testing when the rig is on the site, the release of steam from the cyclonic separator/muffler may emit loud noise levels. Steam release noise will be infrequent and of short duration.

The maximum noise level generated by construction noise sources is expected to be 85 dB(A) at a distance of 50 feet. Thus, at a distance of 0.5 mile, construction noise of 85 dB(A) at 50 feet would be reduced to about 50 dB(A) (equivalent to rural or suburban residential areas during daytime). Construction noise would be expected to meet the ambient 65 dB(A) level (BLM 2007) at a distance of about 500 feet. Well pad construction is estimated to take approximately one week per pad site. Construction noise should be practically indistinguishable from other ambient noises at distances of approximately one mile.

Geothermal Plant Operation

Operational noise would be limited to generation and maintenance noises typical of a geothermal plant and its ancillary facilities, and to plant-related traffic. The steam turbine and cooling tower fans of each proposed geothermal plant would be the greatest source of long-

¹⁰ The L_{eq} noise level may be considered as the continuous steady noise level that would have the same total A-weighted acoustic energy as a fluctuating noise over the same time period.

term noise generated by a project. Turbines can generate up to 85 dB(A) of noise at a distance of three to five feet from the turbines (DOE 2002). Cooling fans can generate noise levels up to 105 dB(a) at a distance of three to five feet from the fans. However, these potential noise levels would be reduced to 26 dB(A) at a distance of 0.5 mile. This noise level would be substantially less than a whispered conversation at six feet, thus not presenting an adverse impact on ambient noise conditions.

4.3.3 Impacts by Alternative

The BLM evaluated the anticipated and potential impacts to noise in the HGLA and surrounding areas under five alternative scenarios. Four of these alternatives represent action alternatives and require amending the current CDCA Plan. Three of these (Alternative A, C, and D) also open some or all of the HGLA for leasing and the use of the HGLA's geothermal resources.

Alternative A – Open the Entire HGLA for Geothermal Exploration and Development; Amend the CDCA Plan to have the HGLA open and available for Geothermal Leasing; Authorize All Pending Lease Applications Within the HGLA

Under Alternative A the CDCA Plan would be amended to reflect the delineated HGLA as open to geothermal leasing for direct and indirect use, and 22,805 acres of BLM-administered lands or federal mineral estate would be made available for geothermal exploration, development, and utilization. Groundwater extraction for consumptive use during exploration, development, and production would be allowed, but controlled or restricted by stipulation. Limited groundwater use may be allowed under certain conditions specified in Chapter 2 and in SA-HGLA-10. Under this alternative the BLM would authorize the three pending non-competitive lease applications for 4,277 acres.

The foreseeable and potential noise impacts associated with Alternative A are discussed in Section 4.3.2.1, above. Alternative A would result in some temporary and permanent increases in ambient noise levels in the HGLA. The degree of impact would vary with the location of potentially sensitive noise receptors relative to the locations of exploration and operation activities. The locations of potentially sensitive noise receptors, and the corresponding degree of impact, would be identified as part of future site-specific permitting studies. For noise-sensitive resources that warrant protection or preservation, the BLM would stipulate appropriate, project-specific mitigation measures. Noise levels would also have to comply with the applicable noise limits issued by Inyo County. Noise impacts from construction would be relatively short-term. Noise impacts from operations would be considered long-term and increase noise levels in the immediate area of the plants, but it would not produce significant increases in noise levels to receptors located more than 0.5

mile from the geothermal generating facilities. However, any future geothermal development project would be required to comply with Inyo County's noise ordinance, thus eliminating any significant impacts beyond the boundaries of the HGLA. In addition to meeting County maximum allowable noise thresholds, leases issued under Alternative A would be subject to other applicable laws, regulations, formal orders, and the terms and conditions of BLM's standard lease form. In the event that future site-specific permitting studies would identify sensitive resources that warrant protection or preservation, the BLM would stipulate appropriate, project-specific onsite mitigation measures.

Alternative B– Close the Entire HGLA to Geothermal Exploration, Development and Leasing; Amend the CDCA Plan to have the HGLA Closed and Unavailable for Geothermal Exploration, Development and Leasing; Deny Authorization of All Pending Leases Within the HGLA

Under Alternative B, BLM-administered lands located within the HGLA would be closed to geothermal leasing, and the CDCA Plan would be amended to reflect that decision. Under this alternative the BLM would not offer competitive geothermal leases on any of the 22,805 acres of BLM-administered lands or federal mineral estate within the HGLA, and would deny the three pending non-competitive lease applications.

Alternative B would not result in any noise impacts because no geothermal development would occur within the HGLA.

Alternative C – Open the HGLA to Geothermal Exploration and Development with Restrictions of NO Surface Occupancy in Sensitive Areas; Amend the CDCA Plan to have the HGLA open and available for Geothermal Leasing; Authorize All Pending Lease Applications Within the HGLA(Preferred Alternative)

Under Alternative C, the CDCA Plan would be amended to reflect the delineated HGLA as open to geothermal leasing for direct and indirect use, but with specific acreages of the HGLA under restrictions of the No Surface Occupancy (NSO) stipulation NSO-HGLA-1. In addition, based on public concerns regarding the use and limited availability of groundwater, groundwater extraction for consumptive use would be prohibited. Under this alternative, the BLM would also authorize the three pending non-competitive lease applications for 4,277 acres.

The NSO stipulation for specific areas of Alternative C will not change the application of the RFD to the HGLA. Therefore, the foreseeable and potential noise impacts associated with Alternative C would be generally similar as those for Alternative A. However, Alternative C

would allow the BLM to control surface use and occupancy in specific areas of the HGLA, which would allow some reduction in noise to certain biological species. Any future geothermal development project would still be required to comply with Inyo County's noise ordinance, and leases issued under Alternative C would be subject to existing laws, regulations, formal orders, and the terms and conditions of BLM's standard lease form.

Alternative D – Selective Closure of Sensitive Resource Areas within the HGLA for Geothermal Exploration and Development; Amend the CDCA Plan to have the HGLA open and available for Geothermal Leasing; Authorize All Pending Lease Applications Within the HGLA

Under Alternative D, the BLM would close specific areas within the HGLA to geothermal leasing to protect sensitive resources while opening the remainder of the HGLA to leasing. Of the 22,805 acres of BLM managed lands or federal mineral estate within the HGLA, 13,773 acres would be closed and the remaining acres would be open in this alternative. In addition, based on public concerns regarding the use and limited availability of groundwater, groundwater extraction for consumptive use would be prohibited. The CDCA Plan would be amended to reflect the specific areas that are open and closed to geothermal exploration, development, and utilization. Under Alternative D, the BLM would also authorize the three modified pending non-competitive lease applications for 4,277 acres.

The selective closure of specific areas of Alternative D will not change the application of the RFD to the HGLA. The foreseeable and potential noise impacts associated with Alternative D would be generally similar as those for Alternatives A and C. However, Alternative D would allow the BLM to close specific areas of the HGLA, which would allow a reduction in noise to some biological species. Closing specific, noise-sensitive areas of the HGLA to geothermal exploration, development, and utilization would ensure that, in addition to meeting County maximum allowable noise thresholds, leases issued under Alternative D would have no unacceptable adverse noise impacts on such areas. In addition, leases issued under Alternative D would be subject to other applicable stipulations, BMPs, and mitigation measures as well as to existing laws, regulations, formal orders, and the terms and conditions of BLM's standard lease form.

Alternative E – No Action

Under the No Action Alternative, the CDCA Plan would not be amended, and the existing plan decisions, stipulations, and allocations would not change as a direct result of this EIS process. The HGLA would remain under management of the current CDCA Plan, which does not identify the HGLA as open or closed to geothermal leasing, nor does it indicate the

availability status of lands within the HGLA. The three pending lease applications would be denied.

Alternative E would not result in any on- or off-site noise impacts because no geothermal development would occur within the HGLA under present CDCA Plan policies and guidelines.

4.4 TOPOGRAPHY, GEOLOGY AND SEISMICITY

4.4.1 Methodology

4.4.1.1 Management Goals

The resource management approaches contained in the Federal Land Policy and Management Act (FLPMA) include:

“...responding to national priority needs for resource use and development, both today and in the future, including such paramount priorities as energy development and transmission, without compromising the basic desert resources of soil, air, water, and vegetation, or public values such as wildlife, cultural resources, or magnificent desert scenery.”

The corresponding, most applicable management goals in the CDCA Plan for geology and mineral resources state:

- Within the multiple-use management framework, assure the availability of known mineral resource lands for exploration and development.
- Encourage the development of mineral resources in a manner which satisfies national and local needs, and provides for economically and environmentally sound exploration, extraction, and reclamation processes.
- Develop a mineral resource inventory, geology-energy-minerals database, and professional, technical, and managerial staff knowledgeable in mineral exploration and development.

The CDCA Plan’s Multiple-Use Class L guidelines provide no specific direction with regard to topography, geology, and seismicity issues.

4.4.1.2 Impact Criteria

The potential direct and indirect impacts of the Haiwee action alternatives on seismicity are assessed with respect to the following impact criteria:

- Increase in the number and magnitude of geothermal-induced seismic events.
- Increase in magmatic or hydrothermal activity.

The potential impacts on seismicity and volcanism from geothermal resource exploration, development, utilization, and decommissioning/reclamation are classified as high, moderate or low intensity over the short- or long-term. The following definitions of high, moderate, and low are used in assessing impacts from the action alternatives:

High

If there are significant impacts on the above criteria.

Moderate

If there are moderate impacts on the above criteria.

Low

If there are minor to no measurable impacts on the above criteria.

4.4.2 Direct/Indirect Impacts

4.4.2.1 General Impacts

As described in the Haiwee RFD, the direct impacts to the land surface of the HGLA as a result of geothermal exploration and development includes the grading and clearing of approximately 384 acres of land. This total includes the clearing of an estimated 62 acres for temperature gradient wells, 202 acres for the two well fields supplying geothermal resource to the two geothermal plants, and an estimated 120 acres for the two geothermal plants and associated road and transmission line infra-structure.

Some seismic or volcanic activity in the HGLA could occur from the land movement along faults, land shaking during earthquakes, or discharge of volcanic materials such as ash, volcanic gas or magma related to changes in subsurface pressures from the extraction and injection of geothermal fluids. However, design of geothermal resource production and injection would minimize changes in reservoir pressure. Geothermal induced micro seismicity (discussed below) is not of sufficient magnitude to rupture the ground, and geothermal induced volcanism is not known. Small local venting of hydrothermal fluids related to extreme shallow pressure drawdowns in some geothermal systems is not likely to occur in the HGLA because the resource is very deep and geothermal developments would be designed to minimize reservoir pressure changes.

The injection and/or extraction of geothermal fluids is known to induce small ($M < 3$) earthquakes in many conventional fractured geothermal systems deeper than 0.6 mile (Majer, et al 2008). Most of the regional seismicity is micro seismicity that appears to be related to the geothermal development of the Coso geothermal field. Similarly, geothermal development in the HGLA may generate increased micro seismicity. In contrast to natural earthquakes, geothermally induced seismic events feel like “a pneumatic hammer, the thud of an object hitting the floor, or a passing truck”. The number and extent of low-magnitude seismic events induced by geothermal development may be proportional to the size of the geothermal facility. There are no baseline data currently available to make a direct correlation to a previously undeveloped area.

The HGLA is currently largely undeveloped economically and has a small human population. The minor, transient nature of the micro seismic events typically related to geothermal activity, relative to the large seismic events which naturally occur in this area; suggest that damage would most likely fall in the nuisance category.

Extensive seismic networks are present to monitor earthquakes in the region operated by the Southern and Northern California Earthquake Centers (SCEC and NCEC) and a micro-earthquake (MEQ) network within the Coso geothermal field.

4.4.2.2 Impacts by Alternative

The BLM evaluated the anticipated and potential impacts to the topography, geology, and seismicity of the HGLA and surrounding areas under five alternative scenarios. Four of these alternatives represent action alternatives and require amending the current CDCA Plan. Three of these (Alternative A, C, and D) also open some or all of the HGLA for leasing and the use of the HGLA’s geothermal resources.

Alternative A – Open the Entire HGLA for Geothermal Exploration and Development; Amend the CDCA Plan to have the HGLA open and available for Geothermal Leasing; Authorize All Pending Lease Applications Within the HGLA

Under Alternative A the CDCA Plan would be amended to reflect the delineated HGLA as open to geothermal leasing for direct and indirect use, and 22,805 acres of BLM-administered lands or federal mineral estate would be made available for geothermal exploration, development, and utilization. Groundwater extraction for consumptive use during exploration, development, and production would be allowed, but controlled or restricted by stipulation. Limited groundwater use may be allowed under certain conditions

specified in Chapter 2 and in SA-HGLA-10. Under this alternative the BLM would authorize the three pending non-competitive lease applications for 4,277 acres.

Development of HGLA's geothermal resources under Alternative A would result in the clearing and grading of an estimated 384 acres for well sites, well fields, and the geothermal generating facilities and associated infra-structure. In addition, utilization of the HGLA geothermal resource could result in some level in local micro seismicity, but the frequency, magnitude, and duration of such events cannot be predicted. However, such impacts are anticipated to be minor. As with most geothermal developments in deep fractured reservoirs for which injection is part of reservoir management, induced micro seismicity is a possibility. However, it is not likely to be significant given the small nature of the seismic events, the sparse population in the vicinity and, most important, the high level of natural seismicity. Extensive seismic monitoring would allow for potential induced seismicity to be monitored for each development.

Development of HGLA's geothermal resources under Alternative A would be conducted consistent with all applicable laws, regulations, formal orders, and the terms and conditions of BLM's standard lease form. In the event that future site-specific permitting studies would identify sensitive resources that warrant additional protection or preservation, the BLM would also stipulate appropriate, project-specific onsite mitigation measures.

Alternative B – Close the Entire HGLA to Geothermal Exploration, Development and Leasing; Amend the CDCA Plan to have the HGLA Closed and Unavailable for Geothermal Exploration, Development and Leasing; Deny Authorization of All Pending Leases Within the HGLA

Under Alternative B, BLM-administered lands located within the HGLA would be closed to geothermal leasing, and the CDCA Plan would be amended to reflect that decision. Under this alternative the BLM would not offer competitive geothermal leases on any of the 22,805 acres of BLM-administered lands or federal mineral estate within the HGLA, and would deny the three pending non-competitive lease applications.

Alternative B would not result in any impacts to the topography, geology, or seismicity of the HGLA or surrounding area because no geothermal development would occur within the HGLA.

Alternative C – Open the HGLA to Geothermal Exploration and Development with Restrictions of NO Surface Occupancy in Sensitive Areas; Amend the CDCA Plan to have the HGLA open and available for Geothermal

Leasing; Authorize All Pending Lease Applications Within the HGLA (Preferred Alternative)

Under Alternative C, the CDCA Plan would be amended to reflect the delineated HGLA as open to geothermal leasing for direct and indirect use, but with specific acreages of the HGLA under restrictions of the No Surface Occupancy (NSO) stipulation NSO-HGLA-1. In addition, based on public concerns regarding the use and limited availability of groundwater, groundwater extraction for consumptive use would be prohibited. Under this alternative, the BLM would also authorize the three pending non-competitive lease applications for 4,277 acres.

The NSO stipulation for specific areas of Alternative C will not change the application of the RFD to the HGLA. The potential impacts, specifically the projected grading and disturbance of an estimated 384 acres and potential for induced micro seismicity, under Alternative C are similar to those of Alternative A. The potential for impacts, under Alternative C, would be reduced or eliminated for the sensitive resources area by the NSO restrictions. The difference then, between alternatives, is that impacts are likely to be more spatially concentrated under Alternatives C and D than in Alternative A. In addition, implementation of the RFD scenario would be conducted consistent with all applicable laws, regulations, formal orders, and the terms and conditions of BLM's standard lease form.

Alternative D – Selective Closure of Sensitive Resource Areas within the HGLA for Geothermal Exploration and Development; Amend the CDCA Plan to have the HGLA open and available for Geothermal Leasing; Authorize All Pending Lease Applications Within the HGLA

Under Alternative D, the BLM would close specific areas within the HGLA to geothermal leasing to protect sensitive resources while opening the remainder of the HGLA to leasing. Of the 22,805 acres of BLM managed lands or federal mineral estate within the HGLA, 13,773 acres would be closed and the remaining acres would be open in this alternative. In addition, based on public concerns regarding the use and limited availability of groundwater, groundwater extraction for consumptive use would be prohibited. The CDCA Plan would be amended to reflect the specific areas that are open and closed to geothermal exploration, development, and utilization. Under Alternative D, the BLM would also authorize the three modified pending non-competitive lease applications for 4,277 acres.

The closure of specific areas under Alternative D will not change the application of the RFD to the HGLA. The potential impacts, specifically the projected grading and disturbance of an estimated 384 acres and potential for induced micro seismicity, under Alternative D are

generally similar to those of Alternative C and to a large degree, Alternative A. The potential for impacts, under Alternative D, would be reduced or eliminated within the sensitive resources area by the closure restrictions. The difference then, between alternatives, is that impacts are likely to be more spatially concentrated under Alternatives C and D, than in Alternative A. As with Alternatives A and C, any future geothermal development project would be required to comply with all applicable stipulations, BMPs, and mitigation measures as well as to existing laws, regulations, formal orders, and the terms and conditions of BLM's standard lease form.

Alternative E – No Action

Under the No Action Alternative, the CDCA Plan would not be amended, and the existing plan decisions, stipulations, and allocations would not change as a direct result of this EIS process. The HGLA would remain under management of the current CDCA Plan, which does not identify the HGLA as open or closed to geothermal leasing, nor does it indicate the availability status of lands within the HGLA. The three pending lease applications would be denied.

As a result, Alternative E would not result in any adverse impacts because no geothermal development would occur within the HGLA under present CDCA Plan policies and guidelines.

4.5 SOILS

4.5.1 Methodology

4.5.1.1 Management Goals

There are no directly applicable CDCA Plan management goals or Multiple-Use Class L guidelines for soil resources. The most applicable goals in the CDCA Plan address geology and minerals resources as follows:

- Within the multiple-use management framework, assure the availability of known mineral resource lands for exploration and development.
- Encourage the development of mineral resources in a manner that satisfies national and local needs, and provides for economically and environmentally sound exploration, extraction, and reclamation processes.

- Develop a mineral resource inventory, geology-energy-minerals database, and professional, technical, and managerial staff knowledgeable in mineral exploration and development.

4.5.1.2 Impact Criteria

Geothermal exploration and development will require new access roads, drilling platforms and sumps, production and reinjection wells, geothermal plant facilities, and pipeline and transmission line rights of way. All of these will entail land disturbance that will require appropriate permits for excavation, grading, and restoration. Clearing and the subsequent construction and operation activities will make the affected soils more vulnerable to erosion from wind and water. Potential impacts to soils were determined in accordance with Appendix G of the California Environmental Quality Act (CEQA) Guidelines. The resultant impacts analysis assessed whether an alternative would:

- Result in substantial soil erosion or loss of topsoil;
- Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of any project component, and potentially result in mass movement such as on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse;
- Affect potential farmland, existing runoff patterns, or habitats through soil removal or loss of topsoil;
- Result in increased runoff from new impermeable areas such as roads, well pads, and plant facilities, which could lead to additional soil erosion; or
- Be located on expansive soil, as defined by the International Building Code (2000)¹¹ and International Code Council (2009), which could result in creating substantial risks to life or property.

4.5.2 Direct/Indirect Impacts

4.5.2.1 General Impacts

The anticipated impacts to soil resources from geothermal exploration and development include physical disturbance (e.g., movement or removal), compaction, changes to erosion patterns, and changes to the largely undisturbed conditions within the initial RFD impact

¹¹The Uniform Building Code was replaced in 2000 by the International Building Code, which considers soils to be expansive if their expansion index is greater than 20 (determined in accordance with ASTM D 4829), or if they meet the following provisions (International Code Council, Inc.2009).

areas covering an estimated 384 acres of the 24,574-acre HGLA. Following post-construction reclamation, the soils in 276 acres of land will remain altered or removed.

The clearing of exploration and construction areas and access roads, drilling of wells, and the movement of vehicles and construction equipment could affect soils in a number of ways. The magnitude of these effects depends on many variables including present vegetative cover, soil slope, and soil characteristics such as texture, depth, moisture, and susceptibility to water and wind erosion. Site clearing activities could result in soil erosion or loss of topsoil in several HGLA soil map units because of their susceptibility to water and/or wind erosion. All of the soil map units in the HGLA are subject to water and/or wind erosion to varying degrees. Exploration and/or construction activities on steep or unstable soils in the HGLA could result in landslides, subsidence, or other mass movements. Mass movements often result from a combination of several factors such as the location of construction sites on unstable soils or steep hillsides, inappropriate placement of fills, modification of surface flow, or inadequate drainage structures. Two characteristics that decrease the stability of soils are cave-in potential and shrink-swell potential. A number of HGLA soils are unstable due to cave-in potential, shrink-swell potential, and/or steepness (slopes $\geq 15\%$).

The movement of heavy construction vehicles and equipment could also result in soil compaction that can result in increased runoff unless controlled and decreased productivity for plant growth since the compacted soil cannot readily exchange gases with the air, or absorb water and plant nutrients. Because the water absorption rate is reduced, water from precipitation runs off compacted soils more readily, and increases soil erosion. Clearing of vegetation typically also increases runoff on any soil unless controlled. As stated above, several of the soil map units in the HGLA are susceptible to erosion. Erosion and loss of topsoil, in turn, affects vegetation cover and wildlife habitats. Soils in the HGLA are not generally used as farmland; they are generally rocky, steep, shallow, or have other limitations that make them unsuitable. In most areas, the lack of irrigation water also limits agricultural development. Only one soil map unit in the HGLA is known to contain farmland: Dunmovin loamy coarse sand, zero to five percent slopes, supports a small amount of irrigated crop acreage (Rockwell International 1980).

Site-specific soils investigations and mapping would take place prior to final facility planning and construction as part of any future permitting studies to identify areas of high erosion hazard and unstable or expansive soils. Construction of the well pads, geothermal plants, and ancillary facilities would be subject to specific stormwater measures contained in the project's Stormwater Pollution Prevention Plan (SWPPP) to prevent erosion and sedimentation of surface waters. The SWPPP would include BMPs as required by a General Construction Activity Stormwater Permit issued by the California State Water Resources Control Board. The SWPPP would be subject to the review and approval of the Regional

Water Quality Control Board. Representative BMPs implemented during all phases of construction would include road maintenance, grading, culvert maintenance and installation, water runoff controls, installation of storm drain inlet protection devices, traffic control in erosion-damaged areas, use of erosion control blankets and soil stabilizers, use of hay bales and sand bags, and mulching exposed ground with a protective cover of organic material such as wood chips or vegetative groundcover. Because these construction activities would include implementation of BMPs and other mitigation measures, overall impacts to the soils of the HGLA are expected to be negligible.

Depending on the location of future geothermal projects, exploration and/or development in the HGLA could also potentially occur on an expansive soil. One soil map unit in the HGLA (Neuralia-Timosea-Typic Argidurids Complex) meets all three criteria required for a soil to be considered expansive. Three additional soils (Dunmovin Variant-Nebona Variant-Alko Variant Complex, Nebona Variant-Alko Variant Cobbly Stone Complex, and Rock Outcrop Haiwee Variant Complex) meet two of three criteria. They are also classified as being very fine-grained. However, the Soils Technical Report for the Coso Geothermal Study Area (Rockwell International, 1980) does not provide specific information about soil particle size, as required by the third criterion.

However, no significant soil conditions are currently known to exist that would preclude development of the Haiwee RFD scenario in the HGLA. A number of soil map units within the area are susceptible to water and wind erosion, but BMPs and mitigation measures would be implemented to minimize or eliminate those impacts. The HGLA soil map units with the most limiting characteristics include:

1. Nebona Variant – Alko Variant cobbly loamy sands, 5 to 30 percent slopes. This soil has the most limiting characteristics of all the map units in the Coso Soil Map area. It is susceptible to water erosion, has shrink-swell potential, has a slope equal to or greater than 15%, and is expansive. This soil unit covers a large area, approximately 5 sections in the south-central portion of HGLA.
2. Dunmovin Variant – Nebona Variant – Alko Variant complex, 2 to 9 percent slopes. This soil is susceptible to wind and water erosion, has shrink-swell potential, and is expansive. It is found in a relatively small area in the southeastern corner of the HGLA (Section 8).
3. Rock outcrop – Haiwee Variant complex, 30 to 50 percent slopes. This soil is susceptible to water erosion, has a slope equal to or greater than 15%, and is expansive. It is found in the northeastern corner of the HGLA over approximately 160 acres.

4. Maynard Lake loamy coarse sand, 15 to 30 percent slopes, and Maynard Lake loamy coarse sand, 2 to 15 percent slopes, have the same characteristics, and are both located in the southeastern portion of the HGLA. Both are susceptible to wind and water erosion, have cave-in potential, and have slopes equal to or greater than 15%.
5. Stumble loamy coarse sand, 15 to 30 percent slopes, Stumble loamy coarse sand, 2 to 15 percent slopes, and Stumble loamy coarse sand, 30 to 50 percent slopes, are three soil units with similar characteristics, and location. All are located in the northeastern portion of the HGLA, susceptible to wind and water erosion, have cave-in potential, and have slopes equal to or greater than 15%.

Environmentally sensitive siting of future RFD facilities, and application of the appropriate BMPs and mitigation measures, are expected to reduce impacts to soils to less than significant levels, resulting in only minor and local, if any, soil loss from the HGLA.

4.5.2.2 Impacts by Alternative

The BLM evaluated the anticipated and potential impacts to HGLA soils under five alternative scenarios. Four of these alternatives represent action alternatives and require amending the current CDCA Plan. Three of these (Alternative A, C, and D) also open some or all of the HGLA for leasing and the use of the HGLA's geothermal resources.

Alternative A – Open the Entire HGLA for Geothermal Exploration and Development; Amend the CDCA Plan to have the HGLA open and available for Geothermal Leasing; Authorize All Pending Lease Applications Within the HGLA

Under Alternative A the CDCA Plan would be amended to reflect the delineated HGLA as open to geothermal leasing for direct and indirect use, and 22,805 acres of BLM-administered lands or federal mineral estate would be made available for geothermal exploration, development, and utilization. Groundwater extraction for consumptive use during exploration, development, and production would be allowed, but controlled or restricted by stipulation. Limited groundwater use may be allowed under certain conditions specified in Chapter 2 and in SA-HGLA-10. Under this alternative the BLM would authorize the three pending non-competitive lease applications for 4,277 acres.

The foreseeable and potential impacts to HGLA soils associated with Alternative A are similar to those discussed in Section 4.5.2.1, above. The degree of impacts to soils will vary with the soil characteristics of future development sites, but consistently includes temporary soil alterations to 384 acres of the HGLA, and long-term alteration to 276 acres. However,

adherence to state and county soil erosion and sediment control measures and construction stormwater management regulations would minimize or eliminate other impacts such as erosion and compaction outside construction areas. In addition, leases issued under Alternative A would be subject to other applicable laws, regulations, formal orders, and the terms and conditions of BLM's standard lease form. In the event that future site-specific permitting studies would identify sensitive resources that warrant protection or preservation, the BLM would stipulate appropriate, project-specific onsite mitigation measures.

Alternative B – Close the Entire HGLA to Geothermal Exploration, Development and Leasing; Amend the CDCA Plan to have the HGLA Closed and Unavailable for Geothermal Exploration, Development and Leasing; Deny Authorization of All Pending Leases Within the HGLA

Under Alternative B, BLM-administered lands located within the HGLA would be closed to geothermal leasing, and the CDCA Plan would be amended to reflect that decision. Under this alternative the BLM would not offer competitive geothermal leases on any of the 22,805 acres of BLM-administered lands or federal mineral estate within the HGLA, and would deny the three pending non-competitive lease applications.

Alternative B would not result in any soil impacts because no geothermal development would occur within the HGLA.

Alternative C – Open the HGLA to Geothermal Exploration and Development with Restrictions of NO Surface Occupancy in Sensitive Areas; Amend the CDCA Plan to have the HGLA open and available for Geothermal Leasing; Authorize All Pending Lease Applications Within the HGLA(Preferred Alternative)

Under Alternative C, the CDCA Plan would be amended to reflect the delineated HGLA as open to geothermal leasing for direct and indirect use, but with specific acreages of the HGLA under restrictions of the No Surface Occupancy (NSO) stipulation NSO-HGLA-1. In addition, based on public concerns regarding the use and limited availability of groundwater, groundwater extraction for consumptive use would be prohibited. Under this alternative, the BLM would also authorize the three pending non-competitive lease applications for 4,277 acres.

The NSO stipulation for specific areas of Alternative C will not change the application of the RFD to the HGLA. The foreseeable and potential impacts to HGLA soils under Alternative C would be generally similar to those for Alternative A, and also result in long-term soil impacts over 276 acres of HGLA soils. These impacts, however, might be more spatially

concentrated due to the NSO stipulation. Due to the flexibility that drilling technology provides, some soils may be avoided by design and routing. This alternative provides the BLM an opportunity to issue additional restrictions for potentially sensitive or unsuitable soils, thus reducing unacceptable adverse impacts.

Alternative D – Selective Closure of Sensitive Resource Areas within the HGLA for Geothermal Exploration and Development; Amend the CDCA Plan to have the HGLA open and available for Geothermal Leasing; Authorize All Pending Lease Applications Within the HGLA

Under Alternative D, the BLM would close specific areas within the HGLA to geothermal leasing to protect sensitive resources while opening the remainder of the HGLA to leasing. Of the 22,805 acres of BLM managed lands or federal mineral estate within the HGLA, approximately 13,773 acres would be closed and the remaining acres would be open in this alternative. In addition, based on public concerns regarding the use and limited availability of groundwater, groundwater extraction for consumptive use would be prohibited. The CDCA Plan would be amended to reflect the specific areas that are open and closed to geothermal exploration, development, and utilization. Under Alternative D, the BLM would also authorize the three modified pending non-competitive lease applications for 4,277 acres.

The closure of specific areas under Alternative D will not change the application of the RFD to the HGLA. The foreseeable and potential impacts to HGLA soils associated with alternative D could result in long-term soil impacts to over 276 acres and are generally similar to those of Alternative C and to a large degree, Alternative A. The potential for impacts, under Alternative D, would be reduced or eliminated within the sensitive resources area by the closure restrictions. The difference then, between alternatives, is that impacts are likely to be more spatially concentrated under Alternatives C and D, than in Alternative A. This alternative allows the BLM to close some unsuitable or sensitive soil map units to development, thus further reducing unacceptable adverse impacts.

Alternative E – No Action

Under the No Action Alternative, the CDCA Plan would not be amended, and the existing plan decisions, stipulations, and allocations would not change as a direct result of this EIS process. The HGLA would remain under management of the current CDCA Plan, which does not identify the HGLA as open or closed to geothermal leasing, nor does it indicate the availability status of lands within the HGLA. The three pending lease applications would be denied.

Alternative E would not result in any impacts to HGLA soils because no geothermal development would occur within the HGLA under present CDCA Plan policies and guidelines.

4.6 WATER RESOURCES

4.6.1 Methodology

4.6.1.1 Management Goals

Surface Water

There are no management goals provided for water resources in the CDCA Plan, although its multiple-Use Class L guidelines address water quality and wetlands as follows:

- Areas designated in this class will be managed to provide for the protection and enhancement of surface and groundwater resources, except for instances of short-term degradation caused by water development projects. Best management practices, developed by the BLM during the planning process outlined in the Clean Water Act, Section 208, et seq., will be used to avoid degradation and to comply with Executive Order 12088.
- Wetland/riparian areas will be considered in all proposed land-use actions. Steps will be taken to provide that these unique characteristics and ecological requirements are managed in accordance with Executive Order 11990, Protection of Wetlands (42 CFR 26951), legislative and Secretarial direction, and BLM Manual 6740, “Wetland Riparian Area Protection and Management” (BLM 1979), as outlined in the Vegetation Element.

The applicable resource management approaches under the FLPMA state:

- “responding to national priority needs for resource use and development, both today and in the future, including such paramount priorities as energy development and transmission, without compromising the basic desert resources of soil, air, water, and vegetation, or public values such as wildlife, cultural resources, or magnificent desert scenery.”

The Vegetation Plan Element of the CDCA Plan also addresses wetlands such as seeps and springs, riparian zones, and mesquite thickets, among others. Wetland-riparian areas, which constitute surface waters, are to be considered in all proposed land use actions where appropriate and legally possible. Steps are to be taken to ensure their unique characteristics and ecological requirements are managed in accordance with legislative, Executive, and

Secretarial directions. To the extent possible all actions are to avoid adverse impacts to wetland and riparian areas.

A key surface water resource in the vicinity of the HGLA is the Coso Hot Springs. Although located more than 10 miles east-southeast from the HGLA, the Coso Hot Springs are addressed in this analysis as a result of their high cultural importance and their listing on the National Register of Historic Places. The Coso Hot Springs are surface manifestations of the Coso geothermal reservoir, although any connection between the hot springs and the reservoir, if one exists, is complex.

The CDCA Water Resources Program requires the analysis of water resources impacts of various activities, including the collection of sufficient data to conduct adequate analysis and the formulation of recommendations for avoiding or mitigating impacts.

Groundwater

CDCA Plan Management goals for groundwater include:

- Comply with state and federal non-degradation policies, Clean Water Act, and wetland and riparian area protection guidelines.
- Areas designated in this class will be managed to minimize degradation of and enhance both surface and groundwater resources as specified in the CDCA Plan, except for instances of short-term degradation caused by water development projects.

4.6.1.2 Impact Criteria

Surface Water

The potential direct and indirect impacts of the Haiwee action alternatives on surface water resources are assessed with respect to the following impact criteria:

- Discharge of dredged or fill materials into waters of the United States, including wetlands;
- Decline of groundwater recharge functions of playa lakes, wetlands, and alluvial fans;
- Reduction of surface water available downstream to creeks, springs, wetlands, and Little Lake;
- Changes to the Coso Hot Springs;

- Violations of State Water Resources Control Board and Lahontan Regional Water Quality Control Board water quality standards and control measures;
- Impairment of beneficial uses of surface waters of the United States and State of California;
- Alteration or impairment of 100-year floodplains, or increase in the potential for flood risks;
- Increase of surface runoff from developed areas that would alter the hydrology of receiving waters;
- Erosion or sedimentation that would alter or impair the course of a perennial or intermittent stream, or substantially alter the area or capacity of a surface water feature; or
- Uses or facilities that would substantially degrade surface or groundwater quality.

Groundwater

The potential direct and indirect impacts of the Haiwee action alternatives on groundwater resources are assessed with respect to the following impact criteria:

- Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level;
- Reduce well yield or increase pumping lift for existing groundwater users in Rose Valley;
- Decline in the productivity or capacity of the Coso geothermal reservoir;
- Violate State Water Resources Control Board and Lahontan Regional Water Quality Control Board groundwater quality standards and control measures;
- Reduce discharge rates or discharge water quality of springs in Rose Valley; or
- Reduce the quantity or quality of groundwater available to sustain lakes, ponds, wetlands, and riparian features at the Little Lake Ranch property at the south end of the valley.

The potential direct and indirect surface and groundwater impacts from geothermal resource exploration, development, utilization, and decommissioning/reclamation are classified as high, moderate or low intensity over the short- or long-term, as follows:

High

If there are significant impacts on the above criteria;

Moderate

If there are moderate impacts on the above criteria; or

Low

If there are minor to no measurable impacts on the above criteria.

4.6.2 Direct/Indirect Impacts

4.6.2.1 General Impacts

Surface Water

General surface water impacts from implementation of the Haiwee RFD scenario could include impacts to wetlands, groundwater recharge areas, surface waters like Little Lake, and floodplains. The HGLA is currently largely undeveloped. As such, new impervious surfaces such as roads, well pads and the various geothermal plant facilities would locally increase the volume of surface water runoff. This impact would be considered long-term since it would occur over the life of the facilities. Direct impacts to the playas within the HGLA could occur from the dredging or discharge of fill material for development of the geothermal plants and associated permanent access roads and transmission line structures. However, geothermal development and facilities would be sited to avoid these playas since they may represent important jurisdictional wetlands.

Direct impacts to the recharge functions of the playa lakes, wetlands, and alluvial fans in the HGLA and surrounding area could occur from filling or the development of such areas by impervious geothermal facilities and access roads. Impervious surfaces would prevent the percolation of runoff that provides groundwater recharge. However, it is expected that geothermal development and facilities would be sited to avoid these important groundwater recharge areas.

Although the source and amount of water required for development and operation of the Haiwee RFD scenario has not been identified, the public's concern for and limited availability of the existing groundwater resources in the HGLA make it unlikely that future projected water needs would come from groundwater extraction in the HGLA or Rose Valley (see below). Should Rose Valley groundwater be produced for project needs, each action

alternative contains specific ground water use restrictions and requirements that limit impacts.

Increased groundwater extraction is unlikely to adversely impact the springs and surface water features in the Rose Valley except in the vicinity of Little Lake. Springs and surface water features in Rose Valley (e.g. Tunawee Canyon Spring, Davis Ranch Springs, Little Lake Canyon Springs) are generally located at higher elevations in the Sierra Nevada foothills on the uplifted side of the Sierra Nevada Fault Zone. Short-term or long-term groundwater withdrawals for the Haiwee RFD facilities would be unlikely to impact these springs because they are located well above the Rose Valley aquifer. In contrast to the Sierra Nevada springs, the surface waters and springs on the Little Lake Ranch property are particularly sensitive to changes in groundwater elevation and flow rates. The Little Lake surface waters and springs rely on groundwater discharge from within the Rose Valley for sustained flow. Analysis presented in the Hay Ranch Groundwater Extraction Project Draft EIR (MHA 2008) indicated that small changes in the groundwater flow rate towards the Little Lake area, or relatively small amounts of water table drawdown, could adversely impact surface water features on the Little Lake Ranch property. As a result, the Hay Ranch Water Extraction Project Hydrology Monitoring and Mitigation Plan (HMMP) specifies that the maximum reduction in groundwater flow rate from the Hay Ranch Groundwater Extraction Project, towards the Little Lake Ranch property be limited to less than 10 percent of current flow. The maximum groundwater table drawdown at the north end of the Little Lake Ranch property (at the Little Lake Ranch North well) is to be limited to less than 0.4 feet from current levels. These action thresholds were also adopted for the impact analysis presented below.

Finally, a 100-year floodplain area exists in the low lying areas of Rose Valley where runoff from the surrounding mountains is captured. This floodplain is considered a high flood risk area. Development of geothermal facilities in the floodplain could alter the functions of the floodplain, increase the potential for flood risks, and cause damage to geothermal facilities including the plants, roads, pipelines, and transmission line structures. As a result, geothermal development should be sited to avoid these flood prone areas.

Groundwater

As currently envisioned, the Haiwee RFD scenario will require water for well drilling, dust control during construction, and makeup water to compensate for evaporative loss during plant operation if the plant designs include conventional, i.e., “wet”, cooling towers. The source for this water is currently unknown. However, based on the expressed public concern for, and limited availability of groundwater underneath the HGLA, the BLM has decided to prohibit or restrict by stipulation any groundwater extraction in the HGLA for consumptive use.

Water will be required for well drilling during geothermal exploration and development. Epsilon Systems Solutions, Inc. (Epsilon) estimated that each deep geothermal well drilled for the nearby Deep Rose Geothermal Project (Epsilon 2005) would require approximately 12 acre-ft of water. Epsilon (2005) estimated water requirements for dust control during drilling activities to be on the order of one acre-ft per well pad per well. An estimated total of 15 production wells and seven injection wells would be drilled over the course of the estimated 30 year lifespan of each power plant. A new production well is estimated to be needed every three years. One seven-acre well pad is required for every five wells. These values indicate a total need for drilling and dust control measures of approximately 300 acre-ft of water, or approximately 10 acre-ft of water per year for each 30 MW geothermal power plant throughout the typical 30-year project life. In addition, drilling of up to 20 temperature gradient wells for geothermal exploration purposes would also require water to prepare drilling fluids. Temperature gradient well drilling would probably require significantly less water than drilling production or injection wells; to conservatively assess potential impacts, a value of five acre-ft per well was assumed, indicating a total need for up to 100 acre-ft of water. These water needs are only necessary during the exploration and development phases, and not over the operational life of the geothermal plant facilities.

Haizlip (2010) estimated that the makeup water necessary to maintain fluid pressures in the geothermal reservoir would be up to approximately 1,450 gallons per minute (gpm), or as much as 2,340 acre-ft per year (ac-ft/yr) for a typical 30 MW dual flash geothermal power plant. The latter calculation assumes that 100% of the fluid lost during evaporative cooling of the geothermal fluid would be made up by the addition of water during reinjection of the condensate. Reinjection of less water than is produced from the geothermal reservoir would result in a gradual reduction in reservoir pressures and/or geothermal fluid yield and, as a consequence, result in a gradual reduction in the quantity of steam available to generate power. The rate of reduction in geothermal fluid availability is dependent on reservoir properties, the degree of development relative to the size and sustainable yield of the geothermal reservoir, and the rate of natural recharge of the geothermal reservoir. As these characteristics have not been determined for the HGLA, the amount of water needed to makeup reservoir losses was estimated from typical evaporative cooling loss rates in comparable dual flash geothermal power plants.

In contrast to the groundwater resources of the HGLA, those of the nearby Coso geothermal area have been more thoroughly studied. Several key dynamic criteria typically define the productive capacity of a geothermal reservoir. Likewise, these criteria can be affected by development of the geothermal reservoir itself or by development of nearby, hydrologically-connected thermal or non-thermal reservoirs. Production, injection or other subsurface activities of geothermal resource development of connected reservoirs or aquifers could

cause reservoir pressure declines, reduction in liquid saturation, changes in cold water influx or other reservoir conditions. If these criteria are affected, then the productivity of the resource could be affected.

From recent geophysical and geochemical data the Coso geothermal reservoir does not connect hydrologically to the surrounding area because:

- 1) The Coso geophysical anomaly for the heat source (partially liquid magma) does not extend significantly northwest into the HGLA, indicating that the geothermal resources in the two areas have a different provenance (Lees 2002).
- 2) As the deep pressures in the Coso geothermal resource decline from brine extraction, deep or shallow ground waters do not replenish the geothermal reservoir fluids significantly (hence the need for the Hay Ranch Groundwater Extraction Hydrologic Monitoring and Mitigation Plan to increase recharge).
- 3) Geochemistry of the Coso geothermal fluids is distinct from the ground water chemistry of other ground waters elsewhere in the Coso Range (Christensen, et al. 2007).
- 4) Micro seismicity within the Coso geothermal field is related to fluid movement within the reservoir. This type of earth movement does not extend to the northwest into the HGLA where seismicity is dominated by movement along mapped faults. These different types of seismic activity indicate different systems of fractures (Bhappacharya, et al. 2002).

More importantly, because the Coso geothermal reservoir does not appear hydrologically connected to the surrounding areas, it may be possible that development of geothermal resources or groundwater resources in the vicinity of the HGLA will not affect the Coso geothermal reservoir, regardless of any development.

Groundwater use in Rose Valley consists of domestic drinking water supply, limited irrigation, light industrial processes and, at the south end of the valley, maintenance of riparian and wetland habitat in the Little Lake area. The Rose Valley aquifer is currently in a near steady-state, recharge to the valley is balanced by discharges. Any additional groundwater extraction could cause localized or more wide-spread draw downs in groundwater. Depending on groundwater extraction rates and proximity to sensitive features like Little Lake, water table drawdown could significantly impact the water available for residential use, irrigation, riparian and wetland habitat, and private wells. Pumping lift for private wells could also be increased, requiring increased energy consumption for ongoing

groundwater extraction. Increased groundwater extraction could also indirectly impact groundwater quality. Although few data are available for the HGLA, deeper groundwater is believed to have higher Total Dissolved Solids (TDS) content than shallow groundwater. Increased groundwater extraction could create upward groundwater gradients. Consequences might be deeper, higher-TDS groundwater closer to the surface and potentially increased TDS in shallow groundwater. This impact could reduce suitability of groundwater for agricultural or drinking water uses.

Potential for Short-Term Impacts

Minor to no measurable impacts would be expected from groundwater extraction needs (estimated at 10 acre-ft/yr) for exploration, development, and dust control for the Haiwee RFD. Currently, truck load quantities of groundwater are extracted for dust control, irrigation, and light industrial activities (pumice mining) from wells near Coso Junction and the Little Lake Ranch property with no detectable impacts to groundwater quality or availability. A 14-day pumping test conducted on the Hay Ranch property in 2007 that produced a total of 88 acre-ft of groundwater had no detectable impact on groundwater quality and drawdown in wells located one mile or farther from the test well.

Potential for Long-Term Impacts

In contrast, moderate to high impacts to existing groundwater users in Rose Valley are expected if continuous groundwater extraction would be conducted to augment the geothermal reservoir fluids under the proposed action. Analysis presented in Appendix G indicated that long-term groundwater extraction from the local, near surface groundwater aquifer, to augment geothermal reservoir fluid levels would likely have significant long-term impacts on groundwater resources in Rose Valley. In particular, surface water features such as Little Lake at the south end of Rose Valley would likely be impacted. In addition, this analysis indicated that groundwater resource impacts from multiple groundwater development projects are likely to be additive. Groundwater extraction rates to offset the projected evaporative loss and loss via other processes were estimated to range up to 2,340 ac-ft/yr for a typical 30 MW geothermal plant, or 4,680 acre-ft/yr for the two geothermal plants projected under the Haiwee RFD scenario. For a typical 30-year geothermal project life, this makeup water extraction represents a significant use of local groundwater. Analysis presented in the Hay Ranch Groundwater Extraction Project Draft EIR (MHA, 2008) indicated that groundwater extraction for that project, at a proposed rate of 4,800 acre-ft/yr for 30 years, would have significant adverse effects on existing groundwater uses in Rose Valley, including a lowering of the local groundwater elevation and reduction of groundwater flow towards Little Lake. The Hay Ranch Groundwater Extraction Project is now up and running. The public has expressed concerns for significant impacts to the groundwater resources during a series of scoping meetings. Information from these meetings,

along with these analyses, resulted in the BLM prohibiting or restricting groundwater extraction for consumptive uses at the HGLA.

A numerical groundwater flow model (Geologica 2010) was used to evaluate potential impacts of prolonged groundwater extraction to support the Haiwee RFD scenario (Appendix G). Simulations were conducted to evaluate the impacts to local groundwater resources from pumping the required makeup water quantities for the following scenarios:

- a) 100% of the makeup water needed for a typical 30 MW geothermal plant (extracting 2,340 ac-ft/yr for 30 years);
- b) 100% of the makeup water needed for two typical 30 MW geothermal plants (extracting 4,680 ac-ft/yr for 30 years); and
- c) Long-term groundwater extraction at a reduced rate to augment geothermal reservoir fluid losses while minimizing potential impacts to critical sensitive receptors (mainly the surface water features on the Little Lake Ranch property).

Results of these evaluations indicated that withdrawal under either scenario A (2,340 ac-ft/yr for 30 years) or scenario B (4,680 ac-ft/yr for 30 years) could increase the depth to groundwater near existing water supply wells in the central portion and north end of Rose Valley. The effects of such pump rates could include increased pumping lift, higher energy costs, and potentially causing some shallower wells to go dry. Also, long-term pumping under either of these scenarios could cause a reduction in groundwater flow towards Little Lake Ranch that would exceed the 10% flow reduction threshold identified in the HMMP for the Hay Ranch project (MHA 2008). Under scenario C, the modeling analysis presented in Appendix G indicated that a long-term (30 year) steady pumping rate of approximately 715 gpm or 1,150 acre-feet/year could be sustained for 30 years without reducing groundwater flow towards Little Lake by more than 10 percent, provided that this was the only major groundwater extraction occurring in the valley (see Section 4.6.5 for discussion of potential cumulative effects).

In regards to the potential for impacts to the developed Coso geothermal resource area, the Coso geothermal reservoir does not appear to be hydrologically or otherwise connected to the surrounding area based on geophysical and geochemical data.

4.6.2.2 Impacts by Alternative

The BLM evaluated the anticipated and potential impacts to the water resources of the HGLA and surrounding areas under five alternative scenarios. Four of these alternatives represent action alternatives and require amending the current CDCA Plan. Three of these

(Alternative A, C, and D) also open some or all of the HGLA for leasing and the use of the HGLA's geothermal resources.

Alternative A – Open the Entire HGLA for Geothermal Exploration, Development and Leasing; Amend the CDCA Plan to have the HGLA Open and Available for Geothermal Exploration, Development and Leasing; Authorize All Pending Leases Within the HGLA

Under Alternative A the CDCA Plan would be amended to reflect the delineated HGLA as open to geothermal leasing for direct and indirect use, and 22,805 acres of BLM-administered lands or federal mineral estate would be made available for geothermal exploration, development, and utilization. Groundwater extraction for consumptive use during exploration, development, and production would be allowed, but controlled or restricted by stipulation. Limited groundwater use may be allowed under certain conditions specified in Chapter 2 and in SA-HGLA-10. Under this alternative the BLM would authorize the three pending non-competitive lease applications for 4,277 acres.

The foreseeable and potential impacts to the water resources of the HGLA and surrounding areas that could be associated with Alternative A are discussed above in Section 4.6.2.1. Assuming that consumptive groundwater use does not occur during exploration and development, the foreseeable and potential impacts of Alternative A to the water resources of the HGLA and surrounding areas are expected to be minor, and largely limited to local changes in groundwater recharge or runoff patterns. Alternately, should consumptive water use occur under specified stipulations during geothermal exploration, development, and operations, impacts would be moderate. With regards to the potential impacts to the Coso Hot Springs, any effects to the hot springs from the proposed action are unlikely under Alternative A (or under any of the alternatives). This is due to the distance between the Coso Hot Springs and the HGLA, the likely discontinuity between geothermal resources between the two areas, and the observed isotopic differences in the waters. Moreover, surface manifestations in such hot springs reflect natural seasonal (and sometimes diurnal) variations (Geologica 2007).

With regard to surface water impacts, the specific locations of ground disturbing activities are not known; however, the acreage of disturbance would likely be spread out within the leasing area. Soil erosion and runoff from disturbed areas could potentially cause increased sedimentation and decrease in water quality in wetlands. However, due to infrequent precipitation in the area, absence of onsite or adjacent surface waters, and implementation of BMPs required under the NPDES General Permit and Inyo County's SWPPP, impacts to water quality are anticipated to be insignificant and not expected to be in violation of water quality standards or impairment of beneficial uses of wetlands. The potential for direct

impacts to the floodplain would be low since geothermal development would be sited to avoid flood prone areas. The increase in impervious surface area would be minimal overall and the potential for impacts to hydrology would be low. In the event that future site-specific permitting studies would identify additional sensitive water resources that warrant protection or preservation, the BLM would stipulate appropriate, project-specific onsite mitigation measures.

Alternative B – Close the Entire HGLA to Geothermal Exploration, Development and Leasing; Amend the CDCA Plan to have the HGLA Closed and Unavailable for Geothermal Exploration, Development and Leasing; Deny Authorization of All Pending Leases Within the HGLA

Under Alternative B, BLM-administered lands located within the HGLA would be closed to geothermal leasing, and the CDCA Plan would be amended to reflect that decision. Under this alternative the BLM would not offer competitive geothermal leases on any of the 22,805 acres of BLM-administered lands or federal mineral estate within the HGLA, and would deny the three pending non-competitive lease applications.

Alternative B would not result in any impacts to the water resources of the HGLA or surrounding areas because no geothermal development would occur within the HGLA.

Alternative C – Open the HGLA to Geothermal Exploration, Development and Leasing; with No Surface Occupancy (NSO) Allowed in Sensitive Areas; Amend the CDCA Plan to have the HGLA Open and Available for Geothermal Leasing; Authorize All Pending Leases within the HGLA (Preferred Alternative)

Under Alternative C, the CDCA Plan would be amended to reflect the delineated HGLA as open to geothermal leasing for direct and indirect use, but with specific acreages of the HGLA under restrictions of the No Surface Occupancy (NSO) stipulation NSO-HGLA-1. In addition, based on public concerns regarding the use and limited availability of groundwater, groundwater extraction for consumptive use would be prohibited. Under this alternative, the BLM would also authorize the three pending non-competitive lease applications for 4,277 acres.

The foreseeable and potential water resource impacts associated with Alternative C would be generally similar to those for Alternative A, except that there would be no impacts related to consumptive water use at any time. Additionally, Alternative C allows for additional protection of specific hydrological features such as playas, wetlands, and floodplains, for example, via issuance of controlled surface use, or NSO restrictions, thereby giving a higher

level of protection to such sensitive areas. The majority of known wetlands and ephemeral streams are located within the sensitive areas being protected. Similarly, the potential for direct impacts to floodplain areas would be low since sensitive resource areas include critical groundwater recharge areas that would be closed to surface disturbance.

The acreage of disturbance might be concentrated in a smaller area than under Alternative A, thus having a greater potential to impact erosion, sedimentation, and recharge, such areas could be protected by design restrictions. Moreover, there would be no increase in the potential for impervious surface area in comparison to the overall HGLA acreage, so the potential for impacts to the hydrology would be low.

As under Alternative A, any future geothermal development project under Alternative C would be required to comply with the corresponding surface and groundwater permit programs by Inyo County and the state. In addition, leases issued under Alternative C would be subject to other applicable existing laws, regulations, formal orders, and the terms and conditions of BLM's standard lease form.

Alternative D – Selective Closure of Sensitive Resource Areas within the HGLA for Geothermal Exploration and Development

Under Alternative D, the BLM would close specific areas within the HGLA to geothermal leasing to protect sensitive resources while opening the remainder of the HGLA to leasing. Of the 22,805 acres of BLM managed lands or federal mineral estate within the HGLA, 13,773 acres would be closed and the remaining acres would be open in this alternative. In addition, based on public concerns regarding the use and limited availability of groundwater, groundwater extraction for consumptive use would be prohibited. The CDCA Plan would be amended to reflect the specific areas that are open and closed to geothermal exploration, development, and utilization. Under Alternative D, the BLM would also authorize the three modified pending non-competitive lease applications for 4,277 acres.

The closure of specific areas under Alternative D will not change the application of the RFD to the HGLA. The foreseeable and potential impacts to HGLA are generally similar to those of Alternative C, providing additional protection to important areas of the watershed. The potential for impacts, under Alternative D, would be reduced or eliminated within the sensitive resources area by the closure restrictions. The difference then, between alternatives, is that surface impacts are likely to be more spatially concentrated under Alternatives C and D, than in Alternative A. The foreseeable and potential impacts associated with Alternative D would be generally similar to those for Alternative C. Any future geothermal development project would be required to comply with the corresponding surface and groundwater permit programs by Inyo County and the state. In addition, leases

issued under Alternative D would be subject to other applicable existing laws, regulations, formal orders, and the terms and conditions of BLM's standard lease form.

Alternative E – No Action

Under the No Action Alternative, the CDCA Plan would not be amended, and the existing plan decisions, stipulations, and allocations would not change as a direct result of this EIS process. The HGLA would remain under management of the current CDCA Plan, which does not identify the HGLA as open or closed to geothermal leasing, nor does it indicate the availability status of lands within the HGLA. The three pending lease applications would be denied.

Alternative E would not result in any water resource impacts because no geothermal development would occur within the HGLA under present CDCA Plan policies and guidelines.

4.7 BIOLOGICAL RESOURCES

4.7.1 Methodology

Environmental consequences to the biological resources of the Haiwee Geothermal Leasing Area (HGLA) and vicinity as a result of the Haiwee RFD scenario are described and evaluated in this section. This evaluation is based on typical disturbances associated with the various stages of geothermal development identified in the RFD. Any future specific geothermal development would be evaluated on a project specific basis and undergo full NEPA analysis and numerous state and local permitting studies. For this EIS, the program's potential impacts on vegetation, wildlife, and their habitats are qualitatively addressed.

4.7.1.1 Management Goals

The management goals of the CDCA Plan identify specific objectives to protect Mojave Desert vegetation communities and wildlife species. The following goals pertain to the HGLA.

Wildlife Management Goals

1. Avoid, mitigate, or compensate for impacts of conflicting uses on wildlife populations and habitats. Promote wildlife populations through habitat enhancement projects so that balanced ecosystems are maintained and wildlife abundance provides for human enjoyment.

2. Develop and implement detailed plans to provide special management for: a) areas which contain rare or unique habitat; b) areas with habitat which is sensitive to conflicting uses; c) areas with habitat which is especially rich in wildlife abundance or diversity; and d) areas which are good representatives of common habitat types. Many areas falling into these categories contain listed species, which may become the focus of management as indicator species.
3. Manage those wildlife species on the federal and state lists of threatened and endangered species and their habitats so that the continued existence of each is not jeopardized. Stabilize and, where possible, improve populations through management and recovery plans developed and implemented cooperatively with the U.S. Fish and Wildlife Service (USFWS) and the California Department of Fish and Game (CDFG).
4. Manage those wildlife species officially designated as sensitive by the BLM for California and their habitats so that the potential for federal or state listing is minimized.
5. Include consideration of crucial habitats of sensitive species in all decisions so that impacts are avoided, mitigated, or compensated.

Vegetation Management Goals

1. Maintain the productivity of the vegetative resource while meeting the consumptive needs of wildlife, livestock, wild horses and burros, and man. Provide for such uses under the principles of sustained yield.
2. Manage those plant species on the federal and state lists of threatened and endangered species and their habitats so that the continued existence of each is not jeopardized. Stabilize and, where possible, improve populations through management and recovery plans developed and implemented cooperatively with the USFWS and the CDFG.
3. Manage those plant species officially designated as sensitive by the BLM for California and their habitats so that the potential for federal or state listing is minimized. Include consideration of sensitive species habitats in all decisions such that impacts are avoided, mitigated, or compensated.

4. Manage unusual plant assemblages so that their continued existence is maintained. In all actions, include consideration of unusual plant assemblages so that impacts are avoided, mitigated or compensated.
5. Accomplish the objectives of other resources by altering plant composition, density, and/or cover.
6. Objectives include eliminating harmful or noxious plants, increasing livestock or wildlife forage production, and improving wildlife habitat characteristics. Diversified, native plant communities are favored over monocultures or communities based on non-native species.

The HGLA is also within the designated Mojave Ground Squirrel Conservation Area, as identified in the West Mojave Plan. Currently the West Mojave Plan serves as the Habitat Management Plan for Mojave ground squirrel conservation on BLM-managed lands, as per the CDCA Plan (BLM 2000). The West Mojave Plan stipulates that permanent new ground disturbance within the Mojave Ground Squirrel Conservation Area be limited to one percent (1%) of existing habitat, or a total of 10,387 acres (BLM 2000).

The BLM manages the Mojave ground squirrel conservation land under the same provisions that apply in the Desert Wildlife Management Areas (DWMAs) as identified in the 1992 CDCA Memorandum of Understanding. The following measures identified for DWMAs include Tortoise Survey Areas and No Survey Areas that apply to the HGLA:

- Within DWMAs, presence-absence surveys and clearance surveys will be required. Tortoises should be moved from the immediate area of impact to adjacent suitable habitat (or burrow). In general, tortoises should be moved no further than 1,000 feet from the impact area. The potential for these animals to wander back into harm's way should be taken into account, and the distance given above modified by the authorized biologist, as necessary.
- Temporary or permanent fences may be needed to prevent tortoise immigration into the impact area.

4.7.1.2 Impact Criteria

The regulatory section of this EIS, (factors utilized to determine the relative importance of the biological resource in the vicinity of the Program) are, in part, based on species and habitats afforded protection under either the California Endangered Species Act (CESA), the federal Endangered Species Act (ESA), the West Mojave Plan or as having special status (e.g., Species of Concern, Sensitive Species, etc.) by the CDFG, USFWS, CNPS, or BLM.

Facility development or operation parameters that are inconsistent with the standards set by the regulatory agencies are considered significant impacts. Violation of the Migratory Bird Treaty Act, Bald and Golden Eagle Protection Act, and Executive Order 11990 – Protection of Wetlands, would also be considered a significant impact.

The selection of impact criteria and assessment of impact levels is based on the Haiwee RFD scenario, the corresponding resource sensitivity, and disturbance associated with each stage of geothermal development as well as the efficacy of the BMPs and other stipulations. There is potential to create both short-term construction-related impacts, and long-term or permanent displacement as a result of permanent habitat changes. Based on the specific type of impact, the potential impact levels have been categorized as either “High,” “Moderate,” or “Low.”

Impact Levels

Impact levels were assigned to both wildlife and vegetation communities, and the individual classification criteria that correspond to these categories are listed in Appendix D. In brief, high levels of impacts include activities that would have direct and unavoidable impacts, and actions that would create a significant adverse change in present populations, individuals, or habitats. High impacts could potentially cause significant unavoidable harm, or stress to wildlife and/or vegetation. Stress is defined as actions that would potentially remove or destroy habitat, or displace or otherwise disturb the species.

Moderate impact levels occur when impacts affect the biota on a local versus regional level; involve only a moderate amount of unavoidable removal of vegetation, habitat, and indirect disturbance; or when they only marginally reduce habitat productivity. Moderate impacts can be expected to cause some stress to wildlife and/or vegetation.

Low levels of impacts are those that do not present a risk to the survival of local populations, or where appropriate BMPs can minimize or eliminate the intensity or duration of the impacts. Low level impacts cause little detectable stress to wildlife and/or vegetation.

4.7.2 Direct/Indirect Impacts

4.7.2.1 General Impacts

The general impacts of the Haiwee RFD scenario on vegetation, wildlife, special status species and important habitats and communities are summarized in Table 4.6-1. It should be noted that, prior to the onset of any disturbance, numerous design measures, and construction and operation procedures and policies would be established to avoid and minimize the potential impacts.

Vegetation

Activities such as site clearing and construction of geothermal facilities will affect the vegetation communities of the HGLA. Impacts to vegetation can include loss of native species and species diversity; increased risk of invasive species introduction; increased risk of topsoil erosion and seed bank depletion; increased risk of fire; creation of fugitive dust; and alteration of topography and drainage patterns.

Short-term impacts, such as crushing of vegetation by vehicles and equipment, is expected to occur during all development phases, and usually have limited lasting effects on vegetation. The potential for establishment of invasive plants can be increased when construction vehicles disturb or alter the structure of existing soils through compaction or excavation. Soil disturbance promotes the ability of non-native plants to compete with native plant species. Other impacts such as permanent removal of vegetation at the construction sites are considered long-term impacts.

Long-term impacts can occur from weed infestations that permanently alter plant species composition and communities. Surface disturbance creates a favorable environment, and use of construction equipment from outside area provides a transport means, for introducing non-native, invasive plant species to the Program area. Because site clearing typically removes the root systems and topsoil, such alterations can also result in the loss of native seed banks. With regard to operational impacts, accidental spills or releases of high-temperature steam or liquids could damage surrounding vegetation communities. Fugitive dust generated by construction activities and traffic has the potential to disperse into surrounding habitats and deposit onto foliage. Foliar deposition may reduce the overall vigor of individual plants by reducing their photosynthetic capabilities and increasing their susceptibility to pests or disease. Fugitive dust also may make plants unsuitable as habitat for insects and birds.

Table 4.6-1 Impact Summary to Biological Resources

Impact Type	Program Impact	Potential Impact and Biological Resource Effects	Impact Type and Longevity
Direct flora injury and/or mortality	Vehicle and human trampling during construction, operation and maintenance	Destruction, mortality, and injury to vegetation, reduction in habitat quantity and quality	Biological disturbance, change, and fragmentation. Long-term within the footprint from construction, access roads, and structures. Short-term in areas adjacent to drilling operations provided that restoration occurs.
Indirect plant injury and/or mortality	Soil compaction, spread of non-native species, deposition of dust and mud, soil erosion	Reduction in habitat quantity and quality, expansion of non-native species, reduction in plant vigor	Biological disturbance, change, and fragmentation. Short-term within the footprint from construction. Long-term for access roads.
Direct fauna injury and/or mortality	Vehicle and human trampling during construction, operation and maintenance	Destruction, mortality, and injury to wildlife species. Nest destruction. Fossorial species and species with limited mobility are most susceptible.	Biological change. Short-term within the footprint from construction, structures, and in areas adjacent to the geothermal plant. Long-term for access roads.
Indirect fauna injury and/or mortality	Vegetation removal, slope erosion, construction noise	Habitat quantity and quality reduction, habitat fragmentation, wildlife displacement	Biological disturbance, change, and fragmentation. Short-term within the footprint from construction. Long-term for access roads and/or vegetation maintenance.
Ground disturbance	Construction, well pads, geothermal plant, tower foundations, access roads	Habitat quantity and quality reduction, habitat fragmentation	Biological disturbance, change, and habitat fragmentation. Short-term within the temporary footprint from construction. Long-term from access roads, well pads, pipeline and geothermal plant location.

Impact Type	Program Impact	Potential Impact and Biological Resource Effects	Impact Type and Longevity
Fugitive dust generation	Construction, maintenance, and repair activities	Reduced photosynthesis, impaired species respiration, reduction in habitat quality	Biological disturbance and change. Short-term within the Program footprint from construction. Long-term from access roads and geothermal plant location.
Exposure to pollutants	Chemical spills from construction and maintenance	Reduce survival, population, and growth	Biological disturbance. Short-term, localized to construction and maintenance sites.
Noise, human presence	Construction, maintenance, and repair activities	Displace wildlife, disrupt breeding, migration, and foraging	Biological disturbance. Short-term within the footprint from construction. Long-term from access roads, well pads, and geothermal plant location.
Fire	Construction and maintenance equipment, human access	Habitat loss and reduction in habitat quality through the potential post-fire establishment of noxious weeds	Biological disturbance, change, fragmentation. Short-term in the construction footprint for the transmission line provided that restoration occurs. Long-term for access roads, well pads, pipeline and geothermal plant location.
Avian collisions	Conductors, shield wires, and guy-wires	Reduction in avian populations; waterfowl and upland game birds would be most susceptible	Biological disturbance. Long-term for transmission line right-of-way (ROW).
Increased predator habitat	Transmission towers	Raptors and corvids exploit perching opportunities, trash, and ponded water, resulting in increased predation on small mammal, tortoises and other bird species	Biological disturbance. Long-term for transmission line ROW.

Wildlife

Habitat loss

Construction activities will destroy a certain amount of wildlife habitat, and depending on the type of habitat, can have a moderate impact on species. Modification of habitat can alter complex interactions between species and their physical environment, resulting in shifts in the dynamic equilibrium among species, with some species declining while other increase in abundance. Geothermal exploration will affect 62 acres. The initial total surface disturbance required for the two geothermal plants would impact more than 200 acres before reclamation of some of these areas. Permanent loss of wildlife habitat removal would occur primarily at the well pads, generating plants, and access roads. The resulting impacts to wildlife would vary depending on the sensitivity of each species and whether sufficient habitat remained after development. Alteration of habitats, such as expected within the transmission line right-of-ways (ROWs), may introduce new species at the expense of “interior” species, thus changing local species composition. Fossorial species are harmed or killed through crushing of burrows. The noise, human presence, and traffic during construction activities can also alter or disrupt breeding and foraging habits, and cause displacement of species that would typically avoid such areas. The extent of such displacement would vary by species, and be partially dependent upon the type of construction activity as well as the duration and intensity. Displaced individuals could be jeopardized if adjacent habitats are already at carrying capacity or if only less suitable habitat is available.

Development of the Haiwee RFD scenario can result in fragmentation of existing habitats. Fragmentation occurs whenever a large continuous habitat is transformed into smaller patches that are separated from each other by either natural or human-induced factors. Developments such as transmission line ROWs can function as a barrier to dispersal for species associated with large tracts of habitat. Fragmentation results in many impacts to wildlife habitat. As the number of fragments increases in a given area, the core area size decreases, reducing the patches uninterrupted by human disturbance. The amount of edge area increases with the increase of fragments, and habitat connectivity decreases with increased fragmentation. Decreased connectivity may favor the habitat generalist wildlife species over the desert-adapted species, threatening species richness or diversity at regional scales (Rogers et al. 1996). Fragmentation by new roads can have a broader effect than just conversion of a small area of land to road surface. Construction of new roads typically increases ease of human access into relatively remote portions of the HGLA and may adversely affect wildlife species that are sensitive to noise or human activities.

Impacts from decommission activities would be similar in nature to impacts from construction, but of a reduced magnitude. Interim reclamation actions are anticipated to be

completed no later than 6 months from when removal of the final well on the location has been completed. There would be temporary increases in noise and visual disturbance associated with the removal of the geothermal facilities and site reclamation. Dispersal of wildlife can occur due to noise, ground vibrations, general human presence associated with reclamation. Negligible to no reduction in wildlife habitat would be expected, and injury and mortality rates of vegetation and wildlife would be much lower than they would be during construction. Areas of temporary impacts would be returned to pre-existing contours and revegetated with a BLM-approved native plant species mix.

Impairment to Normal Behavior

The activities associated with the geothermal development are not expected to significantly impact or restrict wildlife movement. Movement of most Mojave Desert mammal and reptile species takes place at night, when most construction activities other than well drilling would be shut down. Short-term disruptions could occur during construction, with crews and construction activities acting as barriers to movement of wildlife.

Wildlife species are most vulnerable to construction-related disturbances during their breeding season. Disturbances from geothermal construction could result in nest, roost, or territory abandonment and subsequent reproductive failure if these disturbances were to occur during an affected species' breeding season. The season and timing of construction activities could potentially disrupt/disturb or negatively impact mating rituals and/or nesting, or breeding efforts and success, largely due to the high potential for dispersal if birds are scared off their nests from construction noise or presence of people and/or vehicles/equipment nearby. If birds are currently nesting and feel threatened by construction activities or human presence, they may abandon their nests, leaving the eggs or young behind. Nesting birds, their active nests, eggs, and chicks are protected under the Migratory Bird Treaty Act (MBTA). Destruction of an active nest would be a violation of the MBTA. Clearing of dense native vegetation or those areas supporting nesting birds during the nesting season is considered a significant impact. Disturbances from construction could result in nest, roost, or territory abandonment and subsequent reproductive failure if these disturbances were to occur during an affected species' breeding season.

Direct Mortality

The presence of a geothermal development and its associated access roads and ROWs may increase human use of surrounding areas, which in turn could impact wildlife in the surrounding areas through (1) Direct injury or mortality caused by crushing from heavy equipment, maintenance vehicles, or foot traffic; (2) increase in hunting (including poaching); and (3) increased potential for fire, especially in arid or semiarid areas. Individuals displaced from areas cleared of native vegetation for geothermal plants and well pads would be lost if adjacent habitats are at carrying capacity or if they are exposed to an

increased risk of predation. Direct mortality of wildlife is anticipated to occur with geothermal development during habitat clearing, earthwork, grading, digging, and equipment movement. Deaths related to geothermal construction would be incurred primarily by burrow-dwelling animals, eggs and nestlings of bird species with small, well hidden nests (these must be avoided to prevent violation of the MBTA), and species with limited mobility (e.g., lizards, snakes, and ground squirrels). More mobile species like larger mammals (including American badger and kit fox) are expected to disperse into adjacent areas during the land clearing and grading phases associated geothermal construction. Indirect injury or mortality can also be caused by leaving micro trash on-site, such that wildlife may attempt to eat it or feed it to their young.

Terrestrial and avian species could be attracted to ponded water in the well pad sumps. The well pad sumps would store discharged geothermal fluid, runoff from the well pads, and accumulated rainwater. The temperature of the geothermal fluid when it is initially released would be extremely high and fatal to wildlife species. After release, the fluid would cool to ambient temperature. Once the fluid is cooled, the ponds would enhance habitat quality within the immediate area since water is a limiting factor to survival in desert environments. Protection measures such as netting may be required by BLM to deter wildlife from entering the sumps when hot fluids are present.

The Haiwee RFD would include an estimated four miles of new transmission line to connect each of the two geothermal plants with existing transmission lines or substations on the southwest portion of the HGLA. Transmission lines play an important role in concentrating raptor activity (BLM 1980). Raptors and other large aerial perching birds are most susceptible to electrocutions because of their size, distribution, and behavior (Olendorff et al. 1981, Avian Power Line Interaction Committee [APLIC] 2006, Sergio et al. 2005). Species frequently affected by electrocution particularly seem to involve birds of prey, ravens, and other large perching birds (Beavenger 1998). In addition, California spans a significant portion of the Pacific flyway, greatly increasing the number of seasonal transients. The electrical design factor most crucial in avian electrocutions is the physical separation between energized and/or grounded structures, conductors, hardware, or equipment that can be bridged by birds to complete a circuit (APLIC 2006). As a result of conductor and ground wire spacing, electrocution losses are typically less of an issue with high-voltage transmission lines such as those identified in the Haiwee RFD.

4.7.2.2 Impacts by Alternative

Alternative A: Open the Entire HGLA for Geothermal Exploration, Development and Leasing; Amend the CDCA Plan to have the HGLA Open and

Available for Geothermal Exploration, Development and Leasing; Authorize All Pending Leases Within the HGLA

Under Alternative A the CDCA Plan would be amended to reflect the delineated HGLA as open to geothermal leasing for direct and indirect use, and 22,805 acres of BLM-administered lands or federal mineral estate would be made available for geothermal exploration, development, and utilization. Groundwater extraction for consumptive use during exploration, development, and production would be allowed, but controlled or restricted by stipulation. Limited groundwater use may be allowed under certain conditions specified in Chapter 2 and in SA-HGLA-10. Under this alternative the BLM would authorize the three pending non-competitive lease applications for 4,277 acres.

Impacts to biological resources are related to the Haiwee RFD actions (e.g., land disturbance, habitat destruction, erosion, changes in runoff patterns, and hydrological alterations), RFD action emissions (e.g., fugitive dust, sediment runoff, air releases, water releases), and resource use (e.g., water extraction). Many impacts can be reduced or avoided when considered during the siting and design phase. Site-specific measures would be developed as part of future site-specific analysis and permitting conditions at the time of subsequent proposed exploration, development or utilization activities. Leasing of geothermal resources implies that ground disturbance activities associated with the development are likely to impact biological resources. For the purposes of analysis, anticipated development under the RFD for this alternative was assumed.

Vegetation

Total foreseeable surface disturbance for two new geothermal plants and its associated well pads, roads, and pipeline corridors is 384 acres of initial disturbance, and 276 acres long-term after reclamation. Impacts to vegetation include very slow recovery of plant cover, loss or change in native species populations, and reduced species diversity; increased risk of invasive species; increased risk of topsoil erosion and seed bank depletion; increased risk of fire; and alteration of water availability and seed dispersal. Not all vegetation communities listed below would be disturbed by the geothermal development. However, the degradation of native plant communities from geothermal development could contribute to the decline of listed species or their habitat. Table 2-1 and Table 2-2, in Chapter 2, describe the acreage potentially impacted by geothermal leasing.

Vegetation resources could be directly and indirectly affected by construction, operation and maintenance activities. Various phases of construction would occur simultaneously at different locations throughout the construction process. This would require several construction crews operating in these different locations. Impacts to these vegetation

communities are potentially adverse and would require mitigation. Impacts to ruderal and disturbed vegetation and developed land are considered to be minimal and do not require mitigation.

Non-native plant species

Introduction of non-native plant species would occur primarily during construction, and could continue to occur during the operation and maintenance phase of the possible RFD actions. Vehicles moved from other areas supporting non-native or invasive species could introduce non-native or invasive plants by transporting seeds that may be clinging to vehicle structures or that have been incorporated into soil adhering to the vehicle. In addition, the potential for establishment of invasive plants could be increased when construction vehicles alter the structure of existing soils through compaction or excavation, which alters the ability of native plants to compete with introduced plant species. The introduction or spread of non-native plant species would result in adverse impacts without mitigation.

The introduction of noxious weeds can have direct or indirect long-term effects on wildlife and wildlife habitat, and special-status plants and animals in more mesic environments, including stream channels, burned areas, and eroded slopes. Noxious plant species are largely confined to road edges, newly graded areas, and other areas where existing vegetation is crushed and soils are impacted. Potential impacts associated with noxious weed introduction and spread would be minimized through the implementation of mitigation measures.

Wetlands / Drainage

The paleo-Owens River is central to the Rose Valley drainage, encompassing the lower elevations along the western side of the HGLA. There are two man-made permanently flooded lakes at the north end of Rose Valley, but not within the HGLA: the North Haiwee Reservoir and the South Haiwee Reservoir. Little Lake, at the south end of Rose Valley, also not within the HGLA, is a shallow naturally formed lake that has controlled outflow. There are various types of wetlands associated with the edges of these water bodies, especially around the outflow areas. The most notable wetland that is within the designated HGLA is a playa lake in the southwest corner of the Haiwee area. It is part of the overall surface drainage of the Rose Valley. Playa lakes are shallow, unvegetated, intermittent lakes exceeding 20 acres in size that contain water during the wet season and dry up with the absence of rainfall. They are located on flat areas at the lowest part of an undrained desert basin. Surface water resources that may occur within possible RFD actions include desert washes and other streams, the majority of which are ephemeral. Most of these watercourses would be avoided or spanned by the transmission lines. Impacts to wetlands would still occur, for example, where an access road would cross a water course or construction would result in temporary removal or disturbance of riparian vegetation. Impacts to wetlands are major but may be mitigated with the implementation of the Mitigation Measures listed in

Appendix A. Given the proposed water stipulation, SA-HGLA-10, it is unlikely that RFD water use, overall, would have more than a minor impact to wetlands.

Wildlife

Clearing and grading would generate the greatest construction impacts on wildlife, especially in undisturbed portions of BLM-managed land. Noise, dust, visual disturbance from increased human activity, and exhaust emissions from heavy equipment during geothermal construction could result in native habitats adjacent to the construction zone being temporarily unattractive to wildlife. In addition, access roads would create a long-term impact by fragmenting habitat and increasing human access.

Special-Status Species

Special Status Plants

Six special-status plant species have a high potential to occur in the HGLA, including the Darwin Mesa milkvetch, Booth's evening primrose, Kern Canyon clarkia, Amargosa beardtongue, Charlotte's phacelia, and Owens Valley checkerbloom. Refer to Chapter 3 for additional special-status plant species with a moderate to low potential to occur. Geothermal development would potentially result in direct impacts related to removal, burial, or destruction of habitat for these species. Disturbance to plants can also be an indirect impact of geothermal development, as dust or mud deposition may occur during construction, but may not have lasting effects until later, when plant vigor can be reduced due to a drop in photosynthesis. Ground-disturbance activity, including geothermal plant construction and grading of access roads, has the potential to disturb listed plant species. Although the potential for an increase in the spread of invasive and noxious weeds would occur during the construction phase due to increasing traffic and human activity, the potential impacts could be partially reduced by interim reclamation and implementation of BMPs.

Desert Tortoise

The desert tortoise (*Gopherus agassizii*) is a State and Federal Threatened species. The Mojave population of the desert tortoise was listed under the ESA of 1973, as amended, in 1990 (55 FR 12178 12191) and under the CESA. The desert tortoise requires sufficient suitable plants for forage and cover, and suitable substrates for burrows and nest sites. The desert tortoise is threatened by off-road vehicles, livestock grazing, and mining. Disease related to human-caused stress is also taking a heavy toll on the desert tortoise (Berry 2008). This species is present in the northern section of the proposed HGLA. No critical habitat for this species is present within Alternative A. Any direct or indirect impact to the desert tortoise or its occupied habitat (e.g., vehicle crushing a tortoise, habitat removal) from construction would have a substantial adverse effect on one or more individuals of a species that is federal- or state-listed by habitat modification. As the HGLA could affect the species or habitat utilized by the desert tortoise, the BLM will undertake Section 7 consultation,

under the ESA, with USFWS prior to publication of the Final EIS. The findings and mitigation measures required by the USFWS with respect to the desert tortoise would be integrated into RFD action requirements of any alternative that opens the area to leasing and is approved by the BLM (Alternative A, B, or D). Subsequent consultation may be required for any ground disturbing activities that may be proposed.

Mojave Ground Squirrel

The Mojave ground squirrel (*Spermophilus Mojavensis*) is listed as “Threatened” by the State of California (CDFG 2009). Alternative B provides the majority of potential habitat for this species when compared to the other alternatives and has known occurrence records.

Alternative A is within the designated Mojave Ground Squirrel Conservation Area, as identified in the West Mojave Plan. Currently, the West Mojave Plan serves as the Habitat Management Plan for Mojave ground squirrel conservation on BLM-managed lands, as per the CDCA Plan (BLM 2000). There will be several effects from the proposed action on this species, including habitat loss from construction of the geothermal plant, pipeline, well pads, new access roads and transmission lines. Direct mortality or injury can occur if undetected active burrows are crushed by heavy equipment, displacement due to construction noise or vibrations, decreased food availability, and increased predation risk due to loss of vegetation cover. Controlled Surface Use Stipulation CSU-HGLA-1 may be implemented to minimize project impacts to the Mojave ground squirrel. To reduce these potential impacts to this species a lease applicant shall fund, or share in the private-sector funding of, protocol level surveys for Mojave ground squirrel occupancy. The surveys shall follow protocol acceptable to the CDFG and BLM and shall include suitable habitat within the HGLA. If Mojave ground squirrels are detected, the lease Applicant shall consult with BLM and CDFG to establish additional on-site measures to protect the areas occupied by the Mojave ground squirrel.

Burrowing Owl

Although the burrowing owl is not federal- or-state listed, the CDFG requires surveys and mitigation for this declining species, which it considers a Species of Special Concern. Potential habitat and known occurrences have been documented for this species within Alternative A. Direct impacts to this species could occur from the removal of active burrows and direct mortality of owls during Program activities. Indirect impacts could occur from increased noise, lighting, and dust during construction. Although this species is not currently listed by federal agencies, it is a state species of special concern and impacts to this species would be major because the CDFG (Assembly Bill 3180) requires mitigation measures for this species according to currently accepted protocols. As outlined in Appendix A, preconstruction surveys shall be performed in accordance with the accepted CDFG Burrowing Owl Guidelines.

Raptors

Seven special-status raptor species have the potential to occur in the HGLA. Some of these species include golden eagle, northern goshawk, and Swainson's hawk. Given the rugged topography, the well pads and geothermal plants will be located in flatter areas, whereas the raptor species tend to nest in surrounding cliffs. These species are likely to forage within the construction area but unlikely to nest within the potential well pad and geothermal plant sites.

The bald eagle and golden eagle are very sensitive to human activity, especially in the vicinity of nesting area(s), and even distant construction activity (or maintenance activity) could cause abandonment of a nest, subsequent failure, and continuing decline of the species. Human activity within 660 feet of a nest site is considered major and not mitigable, especially if there is direct line-of-sight between the nest site and the human activity, or if the human activity occurs above the nest site in elevation (USFWS 2007). Exceptions to this are if the activity within 660 feet of the nest site (without direct line-of-sight and activity is below the nest site) occurs where there is already an existing disturbance, such as a highly utilized road or utility corridor with existing large structures, or if the RFD action is underground.

Where human activity agitates or bothers roosting or foraging eagles to the degree that causes injury or substantially interferes with breeding, feeding, or sheltering behavior and causes, or is likely to cause, a loss of productivity or nest abandonment, the conduct of the activity constitutes a violation of the Eagle Act's prohibition against disturbing eagles (USFWS 2007). Because these raptor species are not likely to nest on site, and because these species are highly mobile, construction and operation activities are not expected to directly impact raptor species.

Bats

Numerous sensitive bat species have the potential to occur in the rugged terrain surrounding open water sources such as springs, ponds, and water holes. A bat biologist has not investigated the nearby Beebe, Jack Henry, Five Tunnels, and McCloud mines for resident bat colonies. Some of these include the pallid bat and Townsend's Big-Eared bat. Construction activities may have an impact on sensitive bat species if well pads and geothermal plants are located near rocky cliffs. Geothermal resource leases are subject to standard stipulations and lease terms, and include surveys for special-status mammal species. If present, roosting colonies should be flagged and protected by restricting construction activities within 200 feet of roosting locations at dusk when bats leave the roost and at dawn when bats return to the roost. Bats emit species-specific sound frequencies for echolocation. Secondary impacts, such as noise and dust, would be reduced through the implementation of BMPs.

Terrestrial mammals

The American badger and kit fox have the potential to occur in the study area. It is possible that the RFD actions may have short-term indirect effects on these mammal species during construction of the new transmission line. Indirect impacts could also occur from clearing and grading for geothermal plant, well pad and pipeline. The removal of vegetation from these areas could result in the loss of forage and cover for these species. Through the implementation of BMPs, RFD actions activities may affect, but are not likely to adversely affect, populations of these species, if present.

Loggerhead Shrike

Loggerhead shrike (*Lanius ludovicianus*) is listed as a CDFG Species of Special Concern and Fish and Wildlife Service Bird of Conservation Concern. Their range in California extends throughout most of the state except for the northwest. Habitats typically occupied by loggerhead shrike include those possessing open space with patchily distributed trees or shrubs. Deserts possessing spiny shrubs and scrubby vegetation as well as pastoral, agricultural, or suburban settings are frequently occupied (Yousef 1996). Nests will usually be constructed in isolated trees or large shrubs within the occupied habitat. Pairs in California remain together year-round and defend their territories from other individuals of their kind. They typically nest earlier than most other passerines, perhaps as a result of their year-round association with mates (Yousef 1996). This bird species preys mainly on arthropods, reptiles, small mammals and other birds. Another common name of this species is “butcher bird” as they are known to store their prey on thorns and barbed wire.

Based on reported sightings and availability of suitable habitat, this species is expected to have a potential to occur within the Alternative A. Surface disturbance such as clearing for the geothermal plant, pipeline, grading of new or existing access roads would result in habitat and vegetation loss. This would cause habitat degradation which may make the area less appealing to loggerhead shrike individuals. It is expected that preconstruction surveys and/or biological monitoring will locate any nests within shrubs or trees in the area, although if any nests are not located, this could result in injury or mortality of individuals. Construction noise and human presence may cause birds to disperse from the area, potentially abandoning a nest if any birds are nesting nearby during construction. Effects from Alternative A will be minimized by the implementation of BMPs.

Northern sagebrush lizard

The Northern sagebrush lizard has the potential to occur within Alternative A. As temperatures rise, the lizard will appear to escape extreme daytime temperatures by retreating to burrows. They forage and are most active during the morning and evening. During the active season, the lizards spend the night below the sand, on the surface, or in burrows.

Potential impacts to these species include habitat loss leading to a reduction in local species range or dispersal to adjacent, less-suitable habitats; disturbance of general foraging or breeding behavior; and mortality during construction through crushing, grading, or burying that may be required for tower site preparation or construction. Individuals may also become scared of construction activity, noise, and/or vibrations and vacate the area, forcing them to temporarily move to areas which they may be unfamiliar with or which may be unsuitable habitat for them. This may also lead to increased competition or predation from wildlife in adjacent habitats. However, this is a short-term impact, as it is expected that individuals would begin moving back to their native habitat shortly after construction leaves the area or after the area has become at least partially restored through revegetation.

Alternative B – Close the Entire HGLA to Geothermal Exploration, Development and Leasing; Amend the CDCA Plan to have the HGLA Closed and Unavailable for Geothermal Exploration, Development and Leasing; Deny Authorization of All Pending Leases Within the HGLA

Under Alternative B, BLM-administered lands located within the HGLA would be closed to geothermal leasing, and the CDCA Plan would be amended to reflect that decision. Under this alternative the BLM would not offer competitive geothermal leases on any of the 22,805 acres of BLM-administered lands or federal mineral estate within the HGLA, and would deny the three pending non-competitive lease applications. Impacts to all resources would occur as if the proposed action had not been contemplated and the HGLA would not be open to geothermal leasing.

Selecting Alternative B would not facilitate the leasing process for geothermal resources within the HGLA, and would not meet the stated purpose and need to implement Executive Order 13212 as well as the directives of the Energy Policy Act of 2005. Alternative B would not facilitate the processing of the three pending lease applications, nor facilitate analysis of the area's geothermal resource potential. Finally, Alternative B would not assist the State of California in meeting its Renewable Portfolio Standard Goals.

However, throughout the western section of HGLA, ongoing maintenance of the existing transmission lines would continue to occur. This includes complying with regulations governing operation of transmission lines such as maintaining access and spur roads, and vegetation trimming to maintain minimum clearance distances to the conductors and around towers. In addition, several off-highway vehicle (OHV) roads occur within the BLM-managed land increasing human access and utilization of the land. In the absence of the RFD actions or alternatives, biological resources will likely be impacted with continued maintenance and operation of the existing transmission lines and OHV use.

Alternative C: Open the HGLA to Geothermal Exploration, Development and Leasing; with No Surface Occupancy (NSO) Allowed in Sensitive Areas; Amend the CDCA Plan to have the HGLA Open and Available for Geothermal Leasing; Authorize All Pending Leases within the HGLA

Under Alternative C, the CDCA Plan would be amended to reflect the delineated HGLA as open to geothermal leasing for direct and indirect use, but with specific acreages of the HGLA under restrictions of the No Surface Occupancy (NSO) stipulation NSO-HGLA-1. In addition, based on public concerns regarding the use and limited availability of groundwater, groundwater extraction for consumptive use would be prohibited. Under this alternative, the BLM would also authorize the three pending non-competitive lease applications for 4,277 acres.

The foreseeable and potential impacts to the biological resources of the HGLA under Alternative C would be generally similar as those for Alternative A in terms of long-term total acreage losses of vegetation and wildlife habitat. However, Alternative C would provide additional control over surface occupancy in core habitats occupied by sensitive or special-status plant and animal species, including core habitat for the Mojave ground squirrel, desert tortoise, burrowing owl, and northern sagebrush lizard. Potential impacts to vegetation communities and wildlife in areas adjacent to exploration and construction areas would be controlled by the appropriate BMPs and impact mitigation measures and, similar to Alternative A, all phases of geothermal exploration, development, and operation under Alternative C would also comply with all applicable laws, regulations, formal orders, and the terms and conditions of BLM's standard lease form.

Alternative D: Selective Closure of Sensitive Resource Areas within the HGLA for Geothermal Exploration and Development; Amend the CDCA Plan to have Designated Areas within the HGLA Open and Available for Geothermal Leasing; Amend the CDCA Plan to have Designated Areas within the HGLA Closed and Unavailable for Geothermal Leasing; Authorize All Pending Leases Within the HGLA

Under Alternative D, the BLM would close specific areas within the HGLA to geothermal leasing to protect sensitive resources while opening the remainder of the HGLA to leasing. Of the 22,805 acres of BLM managed lands or federal mineral estate within the HGLA, 13,773 acres would be closed and the remaining acres would be open in this alternative. In addition, based on public concerns regarding the use and limited availability of groundwater, groundwater extraction for consumptive use would be prohibited. The CDCA Plan would be amended to reflect the specific areas that are open and closed to geothermal exploration,

development, and utilization. Under Alternative D, the BLM would also authorize the three modified pending non-competitive lease applications for 4,277 acres.

The foreseeable and potential impacts to the biological resources of the HGLA under Alternative D would be generally similar as those for Alternatives A and C in terms of long-term acreage of vegetation and wildlife habitat losses. However, Alternative D would allow the BLM to close areas of the HGLA considered core habitats to sensitive or special-status plant and animal species. This would provide additional protection to those sensitive resources. Potential impacts to vegetation communities and wildlife in areas adjacent to exploration and construction areas would be controlled by the appropriate BMPs and impact mitigation measures. All phases of geothermal exploration, development, and operation under Alternative D would also comply with all applicable laws, regulations, formal orders, and the terms and conditions of BLM's standard lease form.

Alternative E: No Action

Under the No Action Alternative, the CDCA Plan would not be amended, and the existing plan decisions, stipulations, and allocations would not change as a direct result of this EIS process. The HGLA would remain under management of the current CDCA Plan, which does not identify the HGLA as open or closed to geothermal leasing, nor does it indicate the availability status of lands within the HGLA.

The three pending lease applications would be denied based on the analysis and future lease applications in the HGLA would require detailed NEPA analysis and subsequent CDCA Plan amendments. The potential for ground-disturbing activities would exist without consistently developed guidelines, restrictions, and stipulations. Alternative E, however, would not result in any adverse impacts because no geothermal development would occur within the HGLA under present CDCA Plan policies and guidelines.

Taking no action would not facilitate the leasing process for geothermal resources and would not meet the stated purpose and need to implement Executive Order 13212 and the Energy Policy Act. However, it is analyzed in detail to provide a baseline from which to evaluate the other alternatives in accordance with CEQ guidance. For the purposes of the impact analysis and alternative comparison, anticipated development under the RFD was assumed to not occur for this alternative.

4.8 CULTURAL RESOURCES

4.8.1 Methodology

4.8.1.1 Management Goals

The CDCA Plan's management goals addressing cultural resources include:

- Broaden the archaeological and historical knowledge of the CDCA through continuing inventory efforts and the use of existing data. Continue the effort to identify the full array of the CDCA's cultural resources.
- Preserve and protect representative sample of the full array of the CDCA's cultural resources;
- Ensure that cultural resources are given full consideration in land use planning and management decisions, and ensure that BLM authorized actions avoid inadvertent impacts.
- Ensure proper data recovery of significant (Natural Register quality) cultural resources where adverse impacts cannot be avoided.

The corresponding Multiple-Use Class L guidelines for cultural resources state:

- Archaeological values will be preserved and protected. Procedures described in 36 CFR 800 will be observed where applicable.

Proposed leasing actions that would result from alternatives under consideration would also be subject to stipulations and best management practices as provided in the *Record of Decision and Resource Management Plan Amendments for Geothermal Leasing in the Western United States* (December 2008) and its associated *Final Programmatic Environmental Impact Statement* (October 2008) (Western Geothermal PEIS). The conditions of the Western Geothermal PEIS are incorporated by reference, but are restated or summarized here where it is specific to the management of cultural resources in the HGLA.

The Western Geothermal PEIS provides for the imposition of No Surface Occupancy (NSO) stipulations to protect significant historic properties or cultural values. The impositions of the NSO stipulations are considered a major constraint as they do not allow for surface development. For example, a lessee of a NSO area must develop any surface infrastructure outside the NSO area and would need to use advanced technology, such as directional drilling, to access the geothermal resource under the NSO area. These NSO stipulations

would be applied to the standard lease form as condition of the lease. An NSO is appropriate when the standard terms and conditions, other less restrictive lease stipulations (see below), and best management practices for permit approval are determined to be insufficient to achieve the resource protection objectives. An NSO would be considered a reasonable and appropriate management measure to achieve avoidance within the boundary of properties designated or eligible for the National Register of Historic Places, including National Landmarks and National Register Districts and Sites, for additional lands outside the designated boundaries to the extent necessary to protect values where the setting and integrity is critical to their designation or eligibility, and for areas with important cultural and archaeological resources, such as traditional cultural properties and Native American sacred sites, as identified through consultation.

In addition, as stated in the Western Geothermal PEIS and BLM Instruction Memorandum No. 2005-003, the BLM requires the following stipulation to protect cultural resources be made part of any leasing decision:

“This lease may be found to contain historic properties and/or resources protected under the National Historic Preservation Act (NHPA), American Indian Religious Freedom Act, Native American Graves Protection and Repatriation Act, E.O. 13007, or other statutes and executive orders. The BLM will not approve any ground disturbing activities that may affect any such properties or resources until it completes its obligations under applicable requirements of the NHPA and other authorities. The BLM may require modification to exploration or development proposals to protect such properties, or disapprove any activity that is likely to result in adverse effects that cannot be successfully avoided, minimized or mitigated.”

The BLM’s foremost management goal for cultural resources is avoidance of adverse impacts where possible. The BLM may approve exploration or development proposals with conditions that avoid cultural resources that have been determined eligible or are considered potentially eligible to the NRHP, or not authorize an activity likely to result in adverse effects to significant values that cannot be successfully avoided, minimized, or mitigated. Avoidance measures could include moving development elements away from known cultural resources or sensitive areas, encouraging development in previously disturbed areas, or restricting travel to existing roads. Any cultural resource field investigations required by the BLM would be coordinated with consultation with Indian tribes where appropriate and issuance of a Cultural Resource Use Permit (CRUP) under FLPMA.

Consistent with the 36 CFR Part 800 and as described in the Western Geothermal PEIS, before any specific permits are issued under leases, treatment of cultural resources will follow the procedures established by the Advisory Council on Historic Preservation for

compliance with Section 106 of the National Historic Preservation Act. A pedestrian inventory will be undertaken of all portions that have not been previously surveyed or are identified by BLM as requiring inventory to identify properties that are eligible for the NRHP. Those sites not already evaluated for NRHP eligibility will be evaluated based on surface remains, subsurface testing, archival, and/or ethnographic sources. Subsurface testing will be kept to a minimum whenever possible if sufficient information is available to evaluate the site or if avoidance is an expected mitigation outcome. Recommendations regarding the eligibility of sites will be submitted to the BLM, and a treatment plan will be prepared to detail methods for avoidance of impacts or mitigation of effects. The BLM will make determinations of eligibility and effect and consult with SHPO as necessary based on each proposed lease application and project plans. The BLM may require modification to exploration or development proposals to protect such properties, or disapprove any activity that is likely to result in adverse effects that cannot be successfully avoided, minimized or mitigated. Avoidance of impacts through project design will be given priority over data recovery as the preferred mitigation measure. Avoidance measures include moving project elements away from site locations or to areas of previous impacts, restricting travel to existing roads, and maintaining barriers and signs in areas of cultural sensitivity. Any data recovery will be consistent with 36 CFR Part 800 and proceeded by approval of a detailed research design, Native American Consultation, and other requirements for BLM issuance of a permit under the Archaeological Resources Protection Act.

4.8.1.2 Impact Criteria

Where adverse effects to the significant values of cultural resources cannot be avoided, the BLM would comply with Section 106 of the NRHP and its implementing regulations at 36 CFR Part 800. Section 106 requires the BLM to take into account the effects of the proposed federal action on historic properties, which are cultural resources that have been determined eligible or are listed on the NRHP. To be determined eligible for listing on the NRHP, cultural resources must meet one or more of the following four criteria established by the Secretary of the Interior in 36 CFR 60.4:

- A. are associated with events that have made a significant contribution to the broad patterns of history;
- B. are associated with the lives of persons significant in the past;
- C. embody the distinctive characteristics of a type, period, or method of construction, represent the work of a master, possess high artistic value, or represent a significant and distinguishable entity whose components may lack individual distinction; or
- D. have yielded, or may be likely to yield, information important in prehistory or history

A cultural resource that is eligible for listing on the NRHP is referred to as a “historic property” according to the regulations regardless of the time period to which it dates. Also, to be listed in, or determined eligible for, the NRHP a cultural resource must possess integrity. Integrity is defined as the authenticity of a cultural resource’s identity as evidenced by the survival of physical characteristics that existed during the prehistoric or historic period of use. The NRHP recognizes seven aspects that in various combinations define integrity: location, design, setting, materials, workmanship, feeling, and association. Integrity of location means that the cultural resource has not been moved from its historical location. Integrity of design, materials, and workmanship means that an architectural resource’s original building materials, plan, shape, and design elements remain intact. Integrity of setting means the surrounding landscape has changed very little since the period of importance for the resource. Integrity of feeling and association means the cultural resource retains a link to an earlier time and place and is able to evoke that era.

Historic properties must generally be at least 50 years old; however, certain cultural resources associated with more recent, exceptionally important events (e.g., the development of nuclear energy; space exploration) may also be considered eligible to the NRHP.

A proposed federal action, or project, may affect a significant (i.e., NRHP-eligible) historic property when it alters the property’s characteristics or values, including relevant features of its environment or use, that qualify it as significant according to NRHP criteria.

Because of limited survey, we can assume that there remain many cultural resources, primarily archaeological sites, in the HGLA that remain to be identified, recorded and evaluated for NRHP eligibility. Of the 218 known and recorded cultural resources in the HGLA, most have never been subject to NRHP evaluation.

4.8.2 Direct/Indirect Impacts

4.8.2.1 General Impacts

The impact levels for the cultural resource impact assessment are defined as follows:

Adverse

An adverse level of impact to cultural resources would result if the short term activities of exploration drilling, seismic testing, and construction, or the long term operation, or maintenance of the wells, geothermal plants, and possible transmission lines authorized by leasing decisions in this plan would result in identifiable and unavoidable direct, indirect or cumulative impacts to the significant qualities and

values or characteristics and use of cultural resources that are historic properties (e.g., listed in or eligible to the NRHP).

Major

A major impact to cultural resources would result if the exploration drilling and seismic testing or the construction, operation, or maintenance of the proposed project has a high likelihood of causing ground disturbance or other unavoidable changes to the condition of cultural resources (e.g., cultural resources not yet evaluated for NRHP eligibility) or unsurveyed land defined as highly sensitive for containing cultural resources. Major impacts would have a high likelihood of also occurring where construction, operation, or maintenance of the wells, geothermal plants, or possible transmission lines would result in substantial ground disturbance or other changes at or near resources or land defined as high sensitivity. Major impacts would assume that direct, indirect, or cumulative impacts are not identifiable or quantifiable at the planning level, but if a historic property were identified as a result of a leasing action that there is a high likelihood that the impact could not be avoided or minimized, but that the impacts could be mitigated through the imposition of the stipulations and best management practices described above.

Moderate

A moderate impact to cultural resources would result if the exploration drilling and seismic testing or the construction, operation, or maintenance of the proposed project has a moderate likelihood of causing ground disturbance or other adverse change to the condition of cultural resources (e.g., cultural resources not yet evaluated for NRHP eligibility) or unsurveyed land defined as moderately sensitive for containing cultural resources. Impacts would have a moderate likelihood of also occurring where construction, operation, or maintenance of the wells, geothermal plants, or possible transmission lines would result in moderate ground disturbance or other adverse change at or near resources or land defined as moderate sensitivity. Moderate impacts would assume that direct, indirect, or cumulative impacts are not identifiable or quantifiable at the planning level, but if a historic property were identified as a result of a leasing action that there is a moderate likelihood that the impact could not be avoided, but effects could be minimized or mitigated through the imposition of the stipulations and best management practices described above .

Minor

A minor impact to cultural resources would result if the construction, operation, or maintenance of the proposed project would potentially cause any amount of ground disturbance or other adverse changes to cultural resources or lands defined as having low sensitivity and likely to result in a no historic properties finding under Section

106 of the NHPA (e.g., cultural resources determined to be not eligible to the NRHP; land previously surveyed intensively for cultural resources and where no cultural resources were identified). Some previously surveyed areas with no visible cultural resources could still potentially contain buried archaeological sites that are not visible on the surface. Minor would assume that direct, indirect, or cumulative impacts are not identifiable or quantifiable at the planning level, but if a historic property were identified as a result of a leasing action that there is a high likelihood that the impact could be avoided, minimized or mitigated through the imposition of the stipulations and best management practices described above.

Negligible

A negligible impact to cultural resources would result if the construction, operation, or maintenance of the proposed project would potentially cause any amount of ground disturbance or other adverse changes to cultural resources or lands defined as having low sensitivity (e.g., cultural resources determined to be not eligible to the NRHP; land previously surveyed intensively for cultural resources and where no cultural resources were identified). Some previously surveyed areas with no visible cultural resources could still potentially contain buried archaeological sites that are not visible on the surface. Negligible impacts would assume that direct, indirect, or cumulative impacts are not identifiable or quantifiable at the planning level, but if a historic property were identified as a result of a leasing action that there is a high likelihood that the impact could be avoided through the imposition of the stipulations and best management practices described above.

No Identifiable Impact

No identifiable impact would be indicated where no identifiable, measurable or suspected adverse impact would occur to known and recorded cultural resources. These areas would include only those lands where past disturbance, either human-caused or natural, precludes any possibility of containing intact cultural resources.

Geothermal exploration and construction projects (e.g., exploration drilling, seismic testing, well drilling, clearing, grading, earth moving, construction of geothermal plants, off-road vehicle use) have the potential to impact cultural resources, especially archaeological sites whose significant values are most often scientific and informational. Impacts are direct and most obvious whenever the ground surface is disturbed. Ground disturbance destroys the spatial context of archaeological sites and, unless preceded by proper archaeological excavation and analysis, limits the scientific and informational value of the material remains of a site. Impacts to archaeological sites that are visible on the surface are identifiable through survey and evaluation, and pre-approval management prescriptions can be developed to avoid, minimize or mitigate impacts to significant resource values. However,

archaeological resources with no visible surface component may exist in any previously undisturbed area and may be encountered inadvertently during exploration or construction activities.

Seismic testing can be either passive, which causes little ground disturbance, or induced, which typically requires the drilling of holes less than 100 feet deep for the placement of explosives or seismic monitoring devices. Preparation of the construction site and grading of access roads can also impact cultural resources. Ground clearing can compact soils, crush artifacts, and alter prehistoric and historic features. Although some construction activities are temporary, impacts to cultural resources resulting from these activities may be permanent.

Geothermal projects may also have direct impacts on architectural resources, such as buildings, bridges, roads, and other elements of the built environment, by requiring the removal or modification of these features. Architectural resources most often are significant for their associative values (Criteria A-C of the NRHP). Direct impacts to architectural or built-environment resources are identifiable through survey and evaluation, and pre-approval management prescriptions can be developed in advance to avoid, minimize or mitigate impacts to significant resource values.

Geothermal project activities may result in the introduction of access-related impacts to cultural resources by improving existing roads or creating new roads into a previously remote area, thereby increasing pedestrian and vehicle traffic. The likelihood of unauthorized collection of artifacts and intentional, as well as inadvertent, destruction of structures or features increases with ease of access. Impacts resulting from increased access would be predictable and identifiable through survey and evaluation of archaeological sites, and pre-approval management prescriptions can be developed in advance to avoid, minimize or mitigate impacts to significant resource values.

Indirect impacts can generally be described to result from the introduction of visual, auditory, or atmospheric elements in such a way to affect the significant qualities or values of a historic property or its historic setting or context. The most common indirect effect to historic properties results from the introduction of new visual elements in the historic setting of a historic property. For instance, an adverse effect could occur with introduction of a transmission tower or power plant into the historic setting of a historic building. Auditory effects result from the introduction of noise in such a way as to affect the significant values, characteristics and use of a historic property or its setting. Short term effects could result from construction noise or seismic exploration. Long term effects include increased or on-going noise from trucks or power generation. Atmospheric effects result from the introduction of new elements, such as increased dust from construction, dust suppression

chemicals, oil or drilling fluid spills, or man-made water erosion in such a way as to affect the significant qualities, characteristics or use of a historic property or its historic setting.

The introduction of visual, auditory, or atmospheric elements does not automatically result in an adverse effect. The type of intrusion must be considered within in the context significance qualities and values of the historic property. As an example, constructing a transmission tower in the visual and auditory vicinity of an archaeological site would likely have no effect on the significant information values of the site. Indirect impacts resulting from the introduction of visual, auditory, or atmospheric elements in such a way as to affect the significant values, characteristics and use of a historic property or its setting should be identifiable through survey and evaluation, and pre-approval management prescriptions can be developed in advance to avoid, minimize or mitigate impacts to significant resource values.

4.8.2.2 Impacts by Alternative

Alternative A – Open the Entire HGLA for Geothermal Exploration, Development and Leasing; Amend the CDCA Plan to have the HGLA Open and Available for Geothermal Exploration, Development and Leasing; Authorize All Pending Leases Within the HGLA

Under Alternative A the CDCA Plan would be amended to reflect the delineated HGLA as open to geothermal leasing for direct and indirect use, and 22,805 acres of BLM-administered lands or federal mineral estate would be made available for geothermal exploration, development, and utilization. Under this alternative the BLM would authorize the three pending non-competitive lease applications for 4,277 acres. The reasonably foreseeable development of HGLA's geothermal resources under Alternative A would result in the clearing and grading of an estimated 384 acres, or 1.7% of the planning area, for well sites, well fields, the geothermal generating facilities, and associated infra-structure. Through project planning and imposition of stipulations and best management practices, adverse effects would be avoided and any impacts to the significant values of cultural resources are expected to be minor. Alternative A would not change BLM's existing management goals under the CDCA plan for cultural resources within the planning area.

The foreseeable and potential impacts to cultural resources under Alternative A are discussed in the previous section. Under Alternative A impacts to such resources would be avoided or minimized by implementing the stipulations and best management practices described in the Western Geothermal PEIS, as well as BLM cultural resources policy and guidance. This would occur via a pre-exploration and pre-construction cultural resources survey of RFD impact areas to identify their locations and significance, and stipulating appropriate, project-

specific avoidance, minimization, or mitigation measures. Before any specific leases for geothermal exploration or development can be granted by the BLM, treatment of cultural resources would follow the procedures established by the ACHP (36 CFR Part 800) for compliance with Section 106 of the NHPA. Given the limited reasonable and foreseeable development, and the ability to re-design or modify projects to avoid significant impacts within the planning area, impacts under Alternative A would be considered negligible.

Alternative B – Close the Entire HGLA to Geothermal Exploration, Development and Leasing; Amend the CDCA Plan to have the HGLA Closed and Unavailable for Geothermal Exploration, Development and Leasing; Deny Authorization of All Pending Leases Within the HGLA

Under Alternative B, BLM-administered lands located within the HGLA would be closed to geothermal leasing, and the CDCA Plan would be amended to reflect that decision. Under this alternative the BLM would not offer competitive geothermal leases on any of the 22,805 acres of BLM-administered lands or federal mineral estate within the HGLA, and would deny the three pending non-competitive lease applications.

Alternative B would not result in any impacts to cultural resources because no geothermal development would occur within the HGLA. Alternative B would not change BLM's existing management goals under the CDCA plan for cultural resources within the planning area.

Alternative C – Open the HGLA to Geothermal Exploration, Development and Leasing; with No Surface Occupancy (NSO) Allowed in Sensitive Areas; Amend the CDCA Plan to have the HGLA Open and Available for Geothermal Leasing; Authorize All Pending Leases within the HGLA

Under Alternative C, the CDCA Plan would be amended to reflect the delineated HGLA as open to geothermal leasing for direct and indirect use, but with specific acreages of the HGLA under restrictions of the No Surface Occupancy (NSO) stipulations NSO-HGLA-1 and NSO-HGLA-2, as well as Controlled Surface Use stipulations CSU-HGLA-1 and CSU-HGLA-3. Under this alternative, the BLM would also authorize the three pending non-competitive lease applications for 4,277 acres.

The foreseeable and potential impacts to cultural resources under Alternative C are similar to those discussed under Alternative A. However, under Alternative C, the BLM can further eliminate impacts, if necessary, by protecting potentially sensitive or high value cultural resource areas because of the NSO and CSU requirements. Similar to Alternative A, before

any specific leases for geothermal exploration or development can be granted by the BLM, treatment of cultural resources would follow the procedures established by the ACHP (36 CFR part 800) for compliance with Section 106 of the NHPA. Alternative C would not change BLM's existing management goals under the CDCA plan for cultural resources within the planning area. Given the limited reasonable and foreseeable development, and the ability to re-design or modify projects to avoid significant impacts within the planning area, impacts under Alternative C would be considered negligible.

Alternative D – Selective Closure of Sensitive Resource Areas within the HGLA for Geothermal Exploration and Development; Amend the CDCA Plan to have Designated Areas within the HGLA Open and Available for Geothermal Leasing; Amend the CDCA Plan to have Designated Areas within the HGLA Closed and Unavailable for Geothermal Leasing; Authorize All Pending Leases Within the HGLA

Under Alternative D, the BLM would close specific areas within the HGLA to geothermal leasing to protect sensitive resources while opening the remainder of the HGLA to leasing. Of the 22,805 acres of BLM managed lands or federal mineral estate within the HGLA, 13,773 acres would be closed and the remaining acres would be open in this alternative. The CDCA Plan would be amended to reflect the specific areas that are open and closed to geothermal exploration, development, and utilization. Under Alternative D, the BLM would also authorize the three modified pending non-competitive lease applications for 4,277 acres.

The foreseeable and potential impacts to cultural resources, under Alternative D, are similar to those discussed under Alternatives A and C. However, under Alternative D, impacts are reduced because potentially sensitive or high value cultural resource areas are closed to geothermal leasing and subject to the No Surface Occupancy (NSO) stipulations NSO-HGLA-1 and NSO-HGLA-2, as well as Controlled Surface Use stipulations CSU-HGLA-1 and CSU-HGLA-3. Similar to Alternatives A and C, before any specific leases for geothermal exploration or development can be granted by the BLM, treatment of cultural resources would follow the procedures established by the ACHP (36 CFR part 800) for compliance with Section 106 of the NHPA. Alternative D would not change BLM's existing management goals under the CDCA plan for cultural resources within the planning area. Given the limited reasonable and foreseeable development, and the ability to re-design or modify projects to avoid significant impacts within the planning area, impacts under Alternative D would be considered negligible.

Alternative E – No Action

Under the No Action Alternative, the CDCA Plan would not be amended, and the existing plan decisions, stipulations, and allocations would not change as a direct result of this EIS process. The HGLA would remain under management of the current CDCA Plan, which does not identify the HGLA as open or closed to geothermal leasing, nor does it indicate the availability status of lands within the HGLA. The three pending lease applications would be denied.

Alternative E would not result in any impacts to the cultural resources of the HGLA because no geothermal development would occur within the HGLA under present CDCA Plan policies and guidelines. Alternative E would not change BLM's existing management goals under the CDCA plan for cultural resources within the planning area.

4.9 PALEONTOLOGY

4.9.1 Methodology

4.9.1.1 Management Goals

The management goals of the CDCA Plan pertaining to paleontological resources include:

- Ensure that paleontological resources are given full consideration in land use planning and in management decisions;
- Preserve and protect a representative sample of the full array of the CDCA's paleontological resources;
- Ensure proper data recovery of significant paleontological resources where adverse impacts cannot be avoided or otherwise mitigated.

BLM Instruction Memorandum (IM) No. 2008-2009, issued October 15, 2007, states that the Potential Fossil Yield Classification (PFYC) system will be used to classify paleontological resource potential on public lands in order to assess possible impacts and mitigation needs for federal actions involving surface disturbance, land tenure adjustments, and land-use planning. The PFYC classification system for paleontological resources is intended to provide a uniform tool to assess potential occurrences of paleontological resources and evaluate possible impacts. It uses geologic units as base data.

It is also the policy of the BLM (BLM IM 2009-011, October 1, 2008) that potential impacts from federal actions on public lands be identified and assessed, and proper mitigation actions be implemented when necessary to protect scientifically significant paleontological

resources. This IM together with the PFYC system (IM 2008-009) provides guidance for the assessment of potential impacts to paleontological resources, field survey and monitoring procedures, and recommended mitigation measures that would better protect paleontological resources impacted by federal actions.

PRPA (Public Law 111-011 Subtitle D) gives land managing agencies the authority to specifically protect and manage paleontological resources on federal lands. PRPA was passed by Congress in 2009. The BLM is currently in the process of developing guidelines and procedures to manage paleontological resources on its lands using scientific principles and expertise.

Operators will determine whether paleontological resources exist in a project area on the basis of the sedimentary context of the area, a records search for past paleontological finds in the area, and/or, depending on the extent of existing information, a paleontological survey. If paleontological resources are present at the site, or if areas with a high potential to contain paleontological material have been identified, a paleontological resources management plan will be developed. This plan will include a mitigation plan for avoidance, removal of fossils, or monitoring. If an area exhibits a high potential but no fossils were observed during survey, monitoring by a qualified paleontologist may be required during excavation and earthmoving in the sensitive area. The operator will submit a report to the agency documenting these activities. The paleontological resources management plan also will (1) establish a monitoring program, (2) identify measures to prevent potential looting/vandalism or erosion impacts, and (3) address the education of workers and the public to make them aware of the consequences of unauthorized collection of fossils on public land.

4.9.1.2 Impact Criteria

A paleontological resource or site can be considered important when it meets any of the following criteria:

- It is the best example of its kind locally or regionally;
- Illustrates a geologic principle;
- Provides a critical piece of paleo-biological data;
- Encompasses any part of a “type locality” of a fossil or formation;
- Contains a unique or particularly unusual assemblage of fossils;
- Occupies a unique position stratigraphically; or

- Occupies a unique position, proximally, distally or laterally within a formation's extent or distribution

Activities that result in the disturbance or loss of fossils that meet these criteria or that result in the unauthorized collection of such fossils from BLM-managed land would be considered to have impacts on paleontological resources.

As mentioned in Section 3.4.1.3, the entire HGLA is considered to have low potential for containing paleontological resources (D. Storm 2009, personal communication), although Coso Formation deposits in the eastern part of the HGLA could contain fossils.

Therefore, the impact level for paleontological resources for the entire study area is classified as:

Low

A low impact to paleontological resources would result if the construction, operation, or maintenance of the proposed project would potentially cause ground disturbance or other adverse changes to lands that have been defined as having low sensitivity for paleontological resources.

No Identifiable Impact

No identifiable impact would be indicated where no measurable or suspected adverse impact would occur to any paleontological resources. These areas would include only those lands where geologic formations have been demonstrated to contain fossils.

4.9.2 Direct/Indirect Impacts

4.9.2.1 General Impacts

Geothermal exploration and drilling, the construction of geothermal plants and wells, and the construction of roads and transmission lines will have the potential to impact paleontological resources if they are present in the HGLA.

In general, for project areas that are underlain by paleontological sensitive geologic units, the greater the amount of ground disturbance, the higher the potential for impacts to paleontological resources. For project areas that are directly underlain by geologic units with no paleontological sensitivity, there is no potential for impacts on paleontological resources. However, as stated above, the entire HGLA is considered to have low potential for containing paleontological resources.

In some situations, the BLM may determine, based on local geological conditions, that proposed geothermal exploration or construction activities in a specific location warrants further analysis for paleontological resources or monitoring by a paleontologist.

4.9.2.2 Impacts by Alternative

Alternative A – Open the Entire HGLA for Geothermal Exploration, Development and Leasing; Amend the CDCA Plan to have the HGLA Open and Available for Geothermal Exploration, Development and Leasing; Authorize All Pending Leases Within the HGLA

Under Alternative A the CDCA Plan would be amended to reflect the delineated HGLA as open to geothermal leasing for direct and indirect use, and 22,805 acres of BLM-administered lands or federal mineral estate would be made available for geothermal exploration, development, and utilization. Groundwater extraction for consumptive use during exploration, development, and production would be allowed, but controlled or restricted by stipulation. Limited groundwater use may be allowed under certain conditions specified in Chapter 2 and in SA-HGLA-10. Under this alternative the BLM would authorize the three pending non-competitive lease applications for 4,277 acres.

No adverse impacts are expected under Alternative A based on the low probability of occurrence of paleontological resources in the HGLA. In the event that future site-specific permitting studies would identify sensitive resources that warrant protection or preservation, the BLM would stipulate appropriate, project-specific onsite mitigation measures. As a result, impacts under Alternative A, if any, are considered low.

Alternative B – Close the Entire HGLA to Geothermal Exploration, Development and Leasing; Amend the CDCA Plan to have the HGLA Closed and Unavailable for Geothermal Exploration, Development and Leasing; Deny Authorization of All Pending Leases Within the HGLA

Under Alternative B, BLM-administered lands located within the HGLA would be closed to geothermal leasing, and the CDCA Plan would be amended to reflect that decision. Under this alternative the BLM would not offer competitive geothermal leases on any of the 22,805 acres of BLM-administered lands or federal mineral estate within the HGLA, and would deny the three pending non-competitive lease applications.

Alternative B would not result in any impacts to paleontological resources because no geothermal development would occur within the HGLA.

Alternative C – Open the HGLA to Geothermal Exploration, Development and Leasing; with No Surface Occupancy (NSO) Allowed in Sensitive Areas; Amend the CDCA Plan to have the HGLA Open and Available for Geothermal Leasing; Authorize All Pending Leases within the HGLA

Under Alternative C, the CDCA Plan would be amended to reflect the delineated HGLA as open to geothermal leasing for direct and indirect use, but with specific acreages of the HGLA under restrictions of the No Surface Occupancy (NSO) stipulation NSO-1. In addition, based on public concerns regarding the use and limited availability of groundwater, groundwater extraction for consumptive use would be prohibited. Under this alternative, the BLM would also authorize the three pending non-competitive lease applications for 4,277 acres.

No adverse impacts are expected under Alternative C based on the low probability of occurrence of paleontological resources in the HGLA. In the event that future site-specific permitting studies would identify sensitive resources that warrant protection or preservation in the NSO area, Alternative C would provide some additional protection compared to Alternative A.

Alternative D – Selective Closure of Sensitive Resource Areas within the HGLA for Geothermal Exploration and Development; Amend the CDCA Plan to have Designated Areas within the HGLA Open and Available for Geothermal Leasing; Amend the CDCA Plan to have Designated Areas within the HGLA Closed and Unavailable for Geothermal Leasing; Authorize All Pending Leases Within the HGLA

Under Alternative D, the BLM would close specific areas within the HGLA to geothermal leasing to protect sensitive resources while opening the remainder of the HGLA to leasing. Of the 22,805 acres of BLM managed lands or federal mineral estate within the HGLA, 13,773 acres would be closed and the remaining acres would be open in this alternative. In addition, based on public concerns regarding the use and limited availability of groundwater, groundwater extraction for consumptive use would be prohibited. The CDCA Plan would be amended to reflect the specific areas that are open and closed to geothermal exploration, development, and utilization. Under Alternative D, the BLM would also authorize the three modified pending non-competitive lease applications for 4,277 acres.

No adverse impacts are expected under Alternative D based on the low probability of occurrence of paleontological resources in the HGLA, additional protection of

paleontological resources that may occur in the closed areas would be provided in this Alternative as compared to Alternative A.

Alternative E – No Action

Under the No Action Alternative, the CDCA Plan would not be amended, and the existing plan decisions, stipulations, and allocations would not change as a direct result of this EIS process. The HGLA would remain under management of the current CDCA Plan, which does not identify the HGLA as open or closed to geothermal leasing, nor does it indicate the availability status of lands within the HGLA. The three pending lease applications would be denied.

Alternative E would not result in impacts to paleontological resources because no geothermal development would occur within the HGLA under present CDCA Plan policies and guidelines.

4.10 VISUAL RESOURCES

4.10.1 Methodology

Visual resource impacts could result from implementation of specific elements of the Haiwee RFD scenario, including initial exploration of the HGLA and the subsequent construction, operation and maintenance of new wells, two 30 MW geothermal plants, access roads, and new transmission lines.

Visual resource impacts could be caused by these activities and new facilities being seen from sensitive viewpoints, and from their effects to the inherent aesthetic values of the landscape and scenic quality. Impacts to sensitive viewers and landscape scenic quality would typically be highest when influenced by the following changes to the landscape related to future development in the HGLA.

Short-term

- Fugitive dust from site preparation and ground clearing activities,
- High profile and/or large construction equipment such as cranes, loaders, bulldozers, cement trucks, or
- Nighttime lighting required for construction and safety.

Long-term

- Geothermal plant facilities including cooling towers and well heads,
- Linear facilities including roads, transmission lines, and above-ground pipelines,
- Permanent ground disturbance and vegetation clearing,
- Water vapor emanating from the cooling tower, or
- Nighttime lighting required for operations, safety, and security.

4.10.1.1 Management Goals

In its Recreation Element the CDCA Plan, states for its Visual Resources Management Program:

- Appropriate levels of management, protection, and rehabilitation on all public lands in the CDCA will be identified, commensurate with visual resource management objectives in the multiple-use class guidelines.”
- Proposed activities will be evaluated to determine the extent of change created in any given landscape and to specify appropriate design or mitigation measures using the Bureau’s contrast rating process.

Visual Resource Inventory (VRI) Classes were established by the Visual Resource Management (VRM) Inventory that preceded this EIS (Michael Clayton 2009), as discussed in Chapter 3. The BLM may establish the VRI Classes as interim VRM Classes in this EIS. However, these VRI Classes have not been officially designated by the BLM.

The visual resource impact assessment complies with the CDCA Plan by assessing the potential impacts of the proposed activities and facilities, and evaluating compliance of the potential activities and facilities with the VRI Classes.

4.10.1.2 Impact Criteria

This visual resource impact assessment is based on the elements of the BLM Contrast Rating Process found in the BLM’s 8400 Series Visual Resources Manual (BLM 1986a). Visual Contrast Rating defines the degree of physical alteration of the landscape setting, which could be perceived without regard to specific viewpoints or viewing conditions. How the visual changes are seen from sensitive viewpoints determines the viewer impacts.

Visual Contrast

Visual contrast is determined by assessing the deviation in form, line, color, texture, scale, and landscape position between elements of the proposed action and its existing landscape setting. The BLM contrast rating system assesses the change created by the landform/water, vegetative, and structural features associated with a given project action within the existing landscape setting. How the visual changes are seen from sensitive viewpoints determines potential viewer impacts. How the visual changes potentially alter the aesthetic appeal of the landscape determines the scenic quality impacts. Contrast levels are typically characterized as strong, moderate, or weak. Each of the contrast components are described below.

Landform Contrast

Landform contrast is created by alteration of landform patterns, exposure of soil, erosion scars, slumping, and other disturbances due to components of the RFD scenario that are uncharacteristic of the existing or natural landscape. Landform contrast is determined by the degree and duration of ground disturbance. Strong landform contrast levels typically occur in areas with high levels of ground disturbance in steep terrain, while weak landform contrast levels typically occur in areas with low levels of ground disturbance. Open pit mining within the HGLA could also influence landform contrast, resulting in weak contrast levels in specific locations where existing disturbance from mining activities occurs.

Vegetation Contrast

Vegetation contrast is the change in cover and patterns that could result from vegetation clearing required for construction and operation of a given project action. Vegetation contrast is determined by the diversity, complexity and density of vegetation types, and the required clearing and construction. Strong vegetation contrast levels occur in areas where extensive, highly visible clearing is required and vegetation is uniform, dense, slow to recover, or may not be allowed to regrow due to height restrictions and safety constraints. Weak vegetation contrast levels occur in areas where vegetation cover is either lacking or sparse, has a high level of recoverability, or is visually compatible with actions where little vegetation clearing is required.

As discussed in Chapter 3, there are 22 distinct cover classifications in the HGLA. Of these, the nine classifications with more than 20 acres in the HGLA are listed in Table 4.10-1.

Table 4.10-1 Cover Classification Matrix

Classification	Vegetation Description	Acreage HGLA	in	Percentage of Action Area	Typical Contrast Level*
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Classification	Vegetation Description	Acreage in HGLA	Percentage of Action Area	Typical Contrast Level*
Inter-Mountain Basins Big Sagebrush Shrubland	Shrubland occurring in basins.	549 acres	2%	Strong
Mojave Mid-Elevation Mixed Desert Scrub	Shrubland on rolling to steep terrain.	9,381 acres	38%	Moderate/Weak
North American Warm Desert Bedrock Cliff and Outcrop	Barren and sparsely vegetated steep cliff faces, narrow canyons, rock outcrops, and scree and talus slopes.	9,594 acres	39%	Weak
North American Warm Desert Pavement	Unvegetated and very sparsely vegetated lands with a pavement-like “desert varnish” on ground surfaces.	292 acres	1%	Weak
North American Warm Desert Riparian Woodland and Shrubland	Riparian corridors dominated by mixture of trees and shrubs.	86 acres	0.30%	Strong
North American Warm Desert Volcanic Rockland	Barren and sparsely vegetated volcanic rocklands.	779 acres	3.00%	Weak
North American Warm Desert Wash	Shrublands and grasslands occurring in linear strips along washes or arroyos.	303 acres	1%	Strong/Moderate
Sonora-Mojave Creosote bush-White Bursage Desert Scrub	Sparse to moderately vegetated shrubland.	3,337 acres	13%	Moderate/Weak**
Sonora-Mojave Mixed Salt Desert Scrub	Shrubland associated with playas and valley bottoms.	96 acres	0.40%	Moderate/Weak

*Contrast levels may vary based on the actual type and density of vegetation confirmed through field surveys and degree of ground disturbance and vegetation clearing requirements for a specific project.

**Strong contrast levels may occur if areas of very dense vegetation are encountered during field surveys for a specific project.

Structure Contrast

Structure contrast examines the compatibility of geothermal facilities with the existing landscape. Structure contrast would be greatest where there are no other existing man-made structures (e.g., buildings, power lines, etc.) visible in the landscape. Existing structures were identified to evaluate levels of contrast that could result from construction and operation of a

geothermal plant. Existing structures that were identified within the HGLA include several high-voltage transmission lines, two LADWP aqueducts, as well as buildings in the communities of Coso Junction and Dunsmuir. Additional structures related to mining activity could also be present within the HGLA and could influence contrast levels at specific locations.

Visual Contrast Levels

Three visual contrast levels (strong, moderate, and weak) are used to describe the potential visual contrast that could result from elements identified in the proposed RFD scenario. The following describes some of the conditions associated with each visual contrast level:

Strong Visual Contrast

- Soil disturbance and construction of new facilities or access roads in steep terrain (steep terrain is generally considered to be 20 percent or greater slopes.),
- Removal of dense overstory or shrub vegetation for new facilities such as geothermal plants, well heads, buildings, transmission lines and pipelines, or road ROWs, or
- Construction of new facilities in a landscape with no existing man-made structures.

Moderate Visual Contrast

- Soil disturbance and construction of new facilities or access roads in rolling terrain with occasional short, steep slopes, (rolling terrain is generally considered to include 10 to 20 percent slopes,
- Removal of scattered overstory, shrub, scrub, riparian and wash vegetation for new facilities such as geothermal plants, well heads, buildings, transmission lines and pipelines, or road ROW, or
- Construction of new facilities in a landscape with existing man-made structures of a dissimilar type or smaller scale.

Weak Visual Contrast

- Soil disturbance and construction of short spur roads or crushed vegetation from overland access to new facility sites in flat terrain (flat terrain is generally considered to include 0 to 10 percent slopes),
- Minimal removal of vegetation for new facilities such as geothermal plants, well heads, buildings, transmission lines and pipelines, or roads ROW, or
- Construction of new facilities in a landscape with existing man-made structures of a similar type or larger scale.

The landform, vegetation, and structure contrast levels are combined to determine an overall visual contrast level, as illustrated in Table 4.10-2. The overall visual contrast levels identified in Table 4.10-2 are based on the general, existing conditions within the HGLA. As

stated above, additional, site-specific visual impact assessments would be performed as part of any future permitting actions.

Table 4.10-2 Visual Contrast Levels Matrix

	VEGETATION CONTRAST								
	Strong			Moderate			Weak		
Landform Contrast									
Strong	S	S	M	S	M	M	S	M	W
Moderate	S	S	M	S	M	W	S	M	W
Weak	S	M	W	S	M	W	M	M	W
Structure Contrast	S	M	W	S	M	W	S	M	W

S = Strong Contrast; M = Moderate Contrast; W = Weak Contrast

Impact Levels

Potential impact levels were identified for the following visual resources:

- Communities
- Recreation and preservation areas (e.g., parks, designated wilderness areas, trails)
- Travel corridors (e.g., highways, roads)
- Cultural sites
- Scenic quality

To determine potential visual impacts, contrast levels for various elements of the Haiwee RFD scenario were compared with the visibility and distance zones from the sensitive viewpoints listed above, and with the existing scenic quality of the HGLA. Tables 4.10-3 and 4.10-4 document the conditions in which each potential impact level for scenic quality and sensitive viewers could occur. Scenic Quality classes A, B and C are defined in Chapter 3, Section 3.10 Visual Resources.

Table 4.10-3 Scenic Quality Impacts

SCENIC QUALITY CLASS	VISUAL CONTRAST		
	Strong	Moderate	Weak
A	H	H	M
B	H	M	L
C	M	L	L

H = High Impacts; M = Moderate Impacts; L = Low Impacts

Table 4.10-4 Sensitive Viewer Impacts

DISTANCE/VISIBILITY THRESHOLD*		VISUAL CONTRAST		
		Strong	Moderate	Weak
0 to 3-5 miles (FG/MG) (BG)	0 to 0.5 miles (FG)	H	M	L
	0.5 to 3-5 miles (MG)	H/M	M/L	L
	Beyond 3-5 miles	M/L	L	L

H = High Impacts; M = Moderate Impacts; L = Low Impacts; FG/MG = Foreground/Middleground; BG = Background* Defining more specific or narrow ranging distance zones would allow for more discreet impact levels to be characterized.

Typically, strong visual contrast resulting under the RFD scenario, when viewed from high sensitivity viewpoints at close range and/or when located within Class A scenic quality landscapes, could result in the highest levels of potential impact. Visual impact levels become generally lower as visual contrast becomes weaker, as the distance from the viewpoint increases, or as the scenic quality of the landscape decreases as, for example, for viewers beyond three miles and/or within Class B or C scenic quality landscapes. Typical visual impact levels are defined as follows:

High Impacts

High visual impact levels for sensitive viewpoints could result from high levels of visual contrast associated with the presence of built elements of the RFD scenario, vegetation removal, and/or exposure of contrasting soil/rock color from ground disturbing activities that are visible within the foreground or middleground distance zones. High visual impact levels for scenic quality could result from strong visual contrast in areas of Class A or Class B scenic quality; although no Class A scenic quality was inventoried within the HGLA.

Moderate Impacts

Moderate visual impacts for sensitive viewpoints could result from moderate levels of visual contrast associated with the presence of built elements of the RFD scenario, vegetation removal, and/or exposure of contrasting soil/rock color from ground disturbing activities that are visible within the foreground or middleground distance zones. Moderate visual impact levels for scenic quality could result from moderate or weak visual contrast in areas of Class B scenic quality, and strong contrast is areas of Class C scenic quality.

Low Impacts

Low visual impacts for sensitive viewpoints could result from weak levels of visual contrast associated with the presence of built elements of the RFD scenario, vegetation removal, and exposure of contrasting soil/rock color from ground disturbing activities that are visible within the foreground or middleground distance zones and all levels of visual contrast in the background distance zone. Low visual impact levels for scenic quality could result from moderate or weak visual contrast in areas of Class C scenic quality.

Because perception of detail and dominance of the landscape generally decreases with increased distance from the viewer, sensitive viewer impacts may vary within a distance zone. Sensitive viewer impacts are likely to be higher within the ‘foreground’ portion and lower within the ‘middleground’ portion of the foreground or middleground distance zones. A distance of 0-0.5 mile is used to define the foreground and a distance of 0.5 to 3-5 miles is used to define the middleground. These distances may require revision for analysis of specific program components at specific locations within the HGLA.

Because this impact assessment is based on BLM’s Haiwee RFD Scenario, the specific locations of facilities and ground disturbances are not known. As such, the program impacts have been discussed in a broad manner using a reasonable ‘worst case scenario’ that does not consider specific variables or mitigation measures that may reduce visual impacts. Design variables or mitigation measures to reduce or eliminate visual impacts were presented in Appendix A.

In addition to evaluating the potential visual impacts, the general compatibility of geothermal resource development with the VRI/VRM Classes identified within the HGLA was also characterized. Table 4.11-5 documents the conditions in which compatibility of each contrast level with each VRI/VRM Class could occur. VRI/VRM Classes are defined in Chapter 3 Section 3.11 Visual Resources.

Table 4.10-5 Compatibility of Contrast Levels with VRI/VRM Classes

VRI/VRM CLASS	VISUAL CONTRAST		
	Strong	Moderate	Weak
Class I*	N/A	N/A	N/A
Class II	No	No	Yes
Class III	Yes	Yes	Yes
Class IV*	N/A	N/A	N/A

*Indicates VRI/VRM Classes that are not present within the HGLA, and therefore not analyzed for visual contrast.

Scenic Quality Impacts

Generally, impacts to areas of Class C scenic quality in the HGLA could be low (refer to Chapter 3 scenic quality mapping of the HGLA). Potential impacts to Class C scenic quality could be low in areas with minimal slopes, vegetation types with moderate to weak contrast levels, and where existing transmission lines or aqueducts are present. Moderate impacts could potentially occur if construction or clearing occurs in areas where the combination of landform, vegetation and structure contrast levels would result in a strong overall contrast rating. This would most likely occur in areas where steep slopes occur, where vegetation types with strong or moderate contrast levels are present, and/or where no existing structures are present. However, moderate to low impacts could result from soil disturbance and vegetation clearing in areas where existing disturbance from mining activity occurs.

Impacts to areas of Class B scenic quality could generally be high to moderate if construction or clearing occurs in these areas due to the presence of steep slopes, the lack of existing structures, and the presence of pockets of vegetation types with strong potential contrast levels. Moderate to low impacts could result from disturbance and clearing in areas of flat to rolling terrain, where vegetation types result in moderate to weak contrast levels, and where existing structures occur. Moderate to low impacts could result from disturbance and clearing in areas where there is existing disturbance from mining activities

The non-competitive lease application areas are comprised solely of Class C scenic quality. Generally, in areas with minimal slopes, vegetation types with moderate to weak contrast levels, and where existing transmission lines or aqueducts are present, potential impacts to Class C scenic quality could be low. Moderate impacts could potentially occur if construction or clearing occurs in areas where the combination of landform, vegetation and structure contrast levels would result in a strong overall contrast rating. This would most likely occur in areas where steep slopes occur, where vegetation types with strong or moderate contrast

levels are present, and where no existing structures are present. Potential strong or moderate contrast levels and potential high or moderate impacts to scenic quality are most likely to occur if construction or clearing occurs in the northeast portion of the area due to steep slopes, the lack of existing structures, and the presence of pockets of vegetation types with strong potential contrast levels.

Sensitive Viewer Impacts

Communities

Low impacts could occur for communities in the background distance zone including Olancho, Haiwee and Little Lake. Olancho is located over 10 miles north of the HGLA. Haiwee is located over five miles north of the HGLA. Little Lake is located over six miles to the south. These communities could have potential distant views of some elements of the RFD scenario, particularly the cooling tower plume, depending on their siting. This could result in low impacts.

The communities of Dunsmuir and Coso Junction are located adjacent to and within the HGLA, respectively. Potential impacts for these communities could range from low to high, depending on the location of specific elements of the RFD Scenario. If geothermal facilities are located close to the communities where they could be a dominant component of the landscape, potential impacts could be high. If facilities and disturbance are located further away, or are screened fully or partially by topography, potential impacts could likely be low to moderate. Geothermal development could potentially be visually dominant when viewed from the communities. Visual dominance of geothermal development could be greatest if they are located very close to the communities, within the foreground distance zone (0-0.5 mile) or in a superior, or higher, position on steep slopes where visibility of the disturbance would be greatest. Generally, high to moderate impacts could occur if geothermal development occurs within the foreground distance zone (0-0.5 mile), while moderate to low impacts could occur if geothermal development occurs within the middleground distance zone (0.5 to 3-5 miles), depending on contrast levels at locations where construction or clearing might occur.

Transportation Corridors

Given the siting of various elements of the Haiwee RFD scenario, potential high visual impacts viewed from U.S. Highway 395 (US 395) could occur. The highway crosses through the southwestern portion of the HGLA and could have foreground or middleground views. Potential visual impacts to US 395 could range from high to low, depending on the location of construction or clearing. Various portions of the highway would have views at various distances of the HGLA.

Generally, minimal slopes and vegetation types with moderate to weak contrast levels occur within the foreground distance zone of US 395. These conditions, combined with the presence of existing transmission lines or aqueducts, could generally result in moderate to low potential visual impacts for the portions of US 395 that could have foreground views of geothermal development activities. Vegetation types with strong contrast levels, and/or a lack of existing structures in the foreground distance zone of US 395, could generally result in high to moderate potential visual impacts for the portions of the highway that could have foreground views of geothermal development activities.

Geothermal development activities, if visible from US 395 would constitute visual intrusions in the “scenic corridor” of the highway and could adversely affect the potential of the corridor to be designated as a California Scenic Highway, based on the program evaluation criteria. Refer to Section 3.13.2 Regulatory Framework for a summary of the evaluation criteria and process. Siting geothermal facilities to minimize visibility from the highway, maximizing the distance of development activities from the highway, and minimizing grading could minimize the level of visual intrusion.

Due to the highway’s location on the floor of the Rose Valley, with mountain views to the east and west, the distant views of mountains could be affected by geothermal development activities located anywhere within the non-competitive leasing area, with the exception of some areas in the northeast portion where activities would likely be screened by topography. Maximizing the distance of any development from US 395, and avoidance of locating geothermal activities at higher elevations where they would be viewed from a lower location, could minimize visual impacts to sensitive viewers along US 395.

Recreation and Preservation Viewpoints

Background views and low impacts would potentially occur to Little Lake Overlook, located over six miles to the south of the HGLA, and to Fossil Falls, located four miles to the south. Impacts to these recreation areas would be greatest if disturbance and facilities are located on south facing slopes or ridges, where they would be highly visible due to their higher elevation and the high level of potential landscape contrast. However, visual impacts would not occur to these recreation sites if facilities and disturbance are located on or below north facing slopes where they would be screened by topography.

Foreground/middleground views and moderate impacts would potentially occur to the Haiwee trailhead, located almost three miles from the HGLA. Impacts would be greatest if disturbance and facilities are located on west facing slopes or ridges, where they would be highly visible due to their higher elevation and the high level of potential landscape contrast. Visual impacts would not occur if facilities and disturbance are located on or below east facing slopes where they would be screened by topography. Low to moderate impacts would

occur if facilities and disturbance are located in the flat to rolling southwest portion of the HGLA at low elevations, with mountain ranges in the background so new facilities would not be “skylined”.

Any impacts to Coso Hot Springs, located over 4.5 miles east of the HGLA, due to potential middleground or background views would be low. The majority of the HGLA would be screened from Coso Hot Springs by topography. Impacts may occur if facilities and disturbance are located on east facing slopes where they would potentially be visible from the springs.

Foreground/middleground views from the Sacatar Trail Wilderness, located 0.5 mile west of the HGLA, and the Coso Range Wilderness, located 0.7 mile northeast of the latter, could potentially occur for dispersed recreation viewers. Since no defined viewpoints (e.g. trails, campgrounds, vista locations) with views of the HGLA have been identified, potential impacts for the wilderness areas are considered to be low.

Additional potentially low impacts could occur to the South Sierra Wilderness for which no defined viewpoints have been identified. The South Sierra Wilderness is located almost six miles to the west of the HGLA. This wilderness area could, however, potentially have background views for dispersed recreation viewers.

In general, program development in the flat or rolling southwest portion of the HGLA would have the least visual impact to the wilderness areas, while locations on slopes and ridges would be more visible and increase potential visual impacts to these areas.

Night Lighting

Depending on the location of the geothermal facilities, on the type of lighting used, and on implementation of appropriate mitigation measures to minimize night-time visibility from sensitive viewpoints and light pollution; night lighting could contribute to potential night-time visual impacts for nearby communities, sensitive viewers along the US 395 corridor, and recreation and preservation viewers.

Cooling Tower Plumes

Viewers in nearby communities, along US 395, and recreation and preservation areas could have views of cooling tower vapor plumes that could result in impacts ranging from low to high, depending on the location of the facility and atmospheric conditions. Typically, the closer facilities are located to sensitive viewpoints, the greater the dominance of the vapor plume in the visual setting, and the greater potential impacts could be.

Compatibility with VRI Classes

The Visual Resource Management Inventory report identified scenic quality rating units, sensitive viewpoints, and VRI classes for the HGLA, which the BLM may establish as interim VRM classes in this EIS (for Class descriptions, refer to Chapter 3).

Geothermal leasing would generally be compatible with VRI/VRM Class III areas. The objective of this class is to partially retain the existing character of the landscape. The level of change to the characteristic landscape is expected to be moderate. Management activities may attract attention, but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.

To meet the VRI/VRM Class III objective, facilities and disturbance should be located where they will not be a dominant element in the landscape for sensitive viewpoints. Locations in the flat to rolling areas of the HGLA that are not immediately adjacent to sensitive viewpoints would generally meet this objective. Locations immediately adjacent to sensitive viewpoints, or on steep slopes and ridges where geothermal activities would be an obvious and potentially dominant element of the landscape, would generally not meet this objective.

The objective of VRM/VRI Class II is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape. Due to the rugged nature of the Class II areas, cut and fill for wells, geothermal plants, and access for these areas would likely be substantial. Geothermal development activities would not likely meet this objective.

4.10.2 Direct/Indirect Impacts

4.10.2.1 Impacts by Alternative

The visual resource impact assessment is largely based on an evaluation of long-term impacts. Although short term impacts are expected to occur during construction as well, they are anticipated to be greatly reduced by implementation of the applicable mitigation measures listed in Appendix A.

Alternative A – Open the Entire HGLA for Geothermal Exploration, Development and Leasing; Amend the CDCA Plan to have the HGLA Open and Available for Geothermal Exploration, Development and Leasing; Authorize All Pending Leases Within the HGLA

Under Alternative A the CDCA Plan would be amended to reflect the delineated HGLA as open to geothermal leasing for direct and indirect use, and 22,805 acres of BLM-

administered lands or federal mineral estate would be made available for geothermal exploration, development, and utilization. Groundwater extraction for consumptive use during exploration, development, and production would be allowed, but controlled or restricted by stipulation. Limited groundwater use may be allowed under certain conditions specified in Chapter 2 and in SA-HGLA-10. Under this alternative the BLM would authorize the three pending non-competitive lease applications for 4,277 acres.

The foreseeable and potential visual impacts associated with Alternative A are discussed above, would vary with the specific location of future RFD facilities relative to sensitive receptors, and would be somewhat subjective. Landform contrast levels could generally be strong to moderate due to steep topography in the northeast portion of the HGLA, and generally weak in the remainder of the HGLA due to relatively flat to rolling terrain. Open pit mining sites could also influence landform contrast, resulting in weak landform contrast levels in specific locations where existing disturbance from mining activities occurs.

Vegetation contrast would vary depending on the type and density of the vegetation. The majority of the HGLA consists of Mojave Mid-Elevation Mixed Desert Scrub vegetation, where moderate to weak vegetation contrast levels could occur, and North American Warm Desert Bedrock Cliff and Outcrop vegetation, where weak vegetation contrast levels could occur. Strong vegetation contrast levels could occur in pockets of North American Warm Desert Wash, Inter-Mountain Basins Big Sagebrush Shrubland, and North American Warm Desert Riparian Woodland and Shrubland vegetation types.

Structure contrast could generally be weak in the vicinity of the existing high voltage transmission lines and aqueducts, moderate in the vicinity of the existing buildings in Coso Junction and Dunsmuir, and strong in the remainder of the HGLA where no existing structures are located. Structure contrast levels could vary in areas of mining activity, dependent on the mining equipment or structures that may be present.

Overall, contrast levels under Alternative A could generally be moderate to high in the eastern and northern portions of the HGLA where steep slopes occur. Landform contrast could be moderate to high due to moderate to high levels of ground disturbance and steep terrain. Vegetation contrast could generally be low to moderate in barren or sparsely vegetated areas and moderate to high in areas of scrub, shrubland or woodland where more uniform and dense vegetation occurs. Structure contrast could generally be high in these areas due to the lack of manmade structures.

Alternative B – Close the Entire HGLA to Geothermal Exploration, Development and Leasing; Amend the CDCA Plan to have the HGLA Closed and

Unavailable for Geothermal Exploration, Development and Leasing; Deny Authorization of All Pending Leases Within the HGLA

Under Alternative B, BLM-administered lands located within the HGLA would be closed to geothermal leasing, and the CDCA Plan would be amended to reflect that decision. Under this alternative the BLM would not offer competitive geothermal leases on any of the 22,805 acres of BLM-administered lands or federal mineral estate within the HGLA, and would deny the three pending non-competitive lease applications.

Alternative B would not result in any visual impacts because no geothermal development would occur within the HGLA.

Alternative C – Open the HGLA to Geothermal Exploration, Development and Leasing; with No Surface Occupancy (NSO) Allowed in Sensitive Areas; Amend the CDCA Plan to have the HGLA Open and Available for Geothermal Leasing; Authorize All Pending Leases within the HGLA

Under Alternative C, the CDCA Plan would be amended to reflect the delineated HGLA as open to geothermal leasing for direct and indirect use, but with specific acreages of the HGLA under restrictions of the No Surface Occupancy (NSO) stipulation NSO-HGLA-1. In addition, based on public concerns regarding the use and limited availability of groundwater, groundwater extraction for consumptive use would be prohibited. Under this alternative, the BLM would also authorize the three pending non-competitive lease applications for 4,277 acres.

The foreseeable and potential visual impact projections for Alternative C would be generally similar as those discussed for Alternative A. However, Alternative C NSO restrictions could increase the distance between RFD facilities and potentially sensitive visual receptors, thus mitigating potentially adverse impacts. Potentially sensitive visual receptors would be identified as part of any future permitting actions to assess the degree of impact.

Alternative D – Selective Closure of Sensitive Resource Areas within the HGLA for Geothermal Exploration and Development; Amend the CDCA Plan to have Designated Areas within the HGLA Open and Available for Geothermal Leasing; Amend the CDCA Plan to have Designated Areas within the HGLA Closed and Unavailable for Geothermal Leasing; Authorize All Pending Leases Within the HGLA

Under Alternative D, the BLM would close specific areas within the HGLA to geothermal leasing to protect sensitive resources while opening the remainder of the HGLA to leasing. Of the 22,805 acres of BLM managed lands or federal mineral estate within the HGLA, 13,773 acres would be closed and the remaining acres would be open in this alternative. In addition, based on public concerns regarding the use and limited availability of groundwater, groundwater extraction for consumptive use would be prohibited. The CDCA Plan would be amended to reflect the specific areas that are open and closed to geothermal exploration, development, and utilization. Under Alternative D, the BLM would also authorize the three modified pending non-competitive lease applications for 4,277 acres.

The foreseeable and potential visual impacts associated with Alternative D would be generally similar as those for Alternatives A and C. However, Alternative D would close specific areas of the HGLA to geothermal leasing which could reduce visual impacts to some areas.

Alternative E – No Action

Under the No Action Alternative, the CDCA Plan would not be amended, and the existing plan decisions, stipulations, and allocations would not change as a direct result of this EIS process. The HGLA would remain under management of the current CDCA Plan, which does not identify the HGLA as open or closed to geothermal leasing, nor does it indicate the availability status of lands within the HGLA. The three pending lease applications would be denied.

Alternative E would not result in any visual impacts because no geothermal development would occur within the HGLA under present CDCA Plan policies and guidelines.

4.11 LANDS AND REALTY

4.11.1 Methodology

4.11.1.1 Management Goals

The CDCA Plan sets forth the following management goals for land tenure adjustments, but not for other elements of the lands and realty program:

- Fully implement the network of joint-use planning corridors to meet projected utility needs to the year 2000; and
- Identify potential sites for geothermal development, wind energy parks, and

geothermal plants.

According to the CDCA Plan new gas, electric, and water transmission facilities as well as cables for interstate communication may be allowed only within appropriately designated corridors. Designated corridors within the HGLA include BLM Designated Utility Corridor A, a two mile wide corridor, and Section 368 Designated Energy Corridor 18-23, an approximately 1,050 foot wide corridor. Both corridors run north-south across the western portion of the HGLA. A one mile wide, five mile long corridor connecting the Coso Known Geothermal Resource Area (KGRA) with Utility Corridor A is also located on the southern portion of the HGLA.

4.11.1.2 Impact Criteria

The potential impacts of future geothermal development to land use resources are assessed with respect to two CDCA Plan management criteria:

- Do RFD actions conflict with multiple-use management of lands administered by the BLM? or
- Will RFD actions result in proposed uses that are incompatible with existing or adjacent land uses?

The potential impacts to land use resources from geothermal exploration, development, production, or closeout are ranked on a high-to-low risk scale as follows:

High

RFD actions have significant impacts on the above criteria;

Medium

RFD actions have moderate impacts on the above criteria; and

Low

RFD actions have minor or no impacts on the above criteria.

4.11.2 Direct/Indirect Impacts

4.11.2.1 General Impacts

Leasing creates a right, which could conflict with other existing or future land use authorizations. The FLPMA requires that prior existing rights must be recognized, so geothermal development would be designed to avoid or minimize impacts to existing

authorized land uses or facilities. Through appropriate coordination with authorized land use holders, physical disturbances or temporary disruptions in use may be acceptable.

Areas of geothermal development and infrastructure such as at the Coso geothermal fields or Hay Ranch Water Extraction and Delivery Project create prior existing rights for the lessees, and could affect the direction or placement of future non geothermal related ROWs. Along the same lines, mission operations at the U.S. Department of Defense's China Lake Naval Air Weapons Station (NAWS) will be taken into consideration. Based on their locations, overhead high voltage transmission lines could potentially have impacts on flight lines and training operations at the China Lake NAWS. As such, coordination between the BLM and Department of Defense would be conducted prior to the approval of any future geothermal energy development to determine project compatibility with current and future military missions, and consistency with the Joint Service Restricted R-2508 Complex.

The potential impacts from management of lands and realty actions are assumed to be low since standard lease stipulations specify that all leasing activities are subject to these existing rights.

4.11.2.2 Impacts by Alternative

Alternative A – Open the Entire HGLA for Geothermal Exploration, Development and Leasing; Amend the CDCA Plan to have the HGLA Open and Available for Geothermal Exploration, Development and Leasing; Authorize All Pending Leases Within the HGLA

Under Alternative A the CDCA Plan would be amended to reflect the delineated HGLA as open to geothermal leasing for direct and indirect use, and 22,805 acres of BLM-administered lands or federal mineral estate would be made available for geothermal exploration, development, and utilization. Groundwater extraction for consumptive use during exploration, development, and production would be allowed, but controlled or restricted by stipulation. Limited groundwater use may be allowed under certain conditions specified in Chapter 2 and in SA-HGLA-10. Under this alternative the BLM would authorize the three pending non-competitive lease applications for 4,277 acres.

The foreseeable and potential impacts to existing rights under Alternative A would be expected to be low based on recognition of existing use classification and prior existing rights. As discussed in Section 3.14.1, BLM lands within the CDCA have been assigned into five multiple use classes (MUC): Lands within the HGLA are designated MUC L which is designed to protect sensitive, natural, scenic, ecological, and cultural resource values. Class L lands within the West Mojave (WEMO) area are “managed to provide for generally lower-intensity, carefully controlled multiple use of resources, while ensuring that sensitive values

are not significantly diminished.” However, geothermal electrical generation facilities may be allowed pursuant to licenses issued under 43 CFR Section 3250, et seq. if all applicable NEPA requirements are met. As a result, this alternative would not conflict with BLM’s multiple-use management objectives. These scenarios would also conform to the CDCA goal to identify potential sites for geothermal development.

Leasing of the subsurface geothermal resources would not affect existing realty agreements. However, development of new facilities, including ROWs, would require new grants.

According to the Land Use Element of the Inyo County General Plan, the HGLA and surrounding region falls within the State and Federal Lands Designation. This designation is characterized by absence of privately owned lands, and applied to those state- and federally-owned parks, forests, recreation, and/or management areas that have adopted management plans (Inyo County 2001). BLM’s Alternative A would be consistent with the Inyo County General Plan, and with the Inyo County Zoning Ordinance. The impacts from implementing the Haiwee RFD on the existing land uses of the HGLA would be low.

Alternative B – Close the Entire HGLA to Geothermal Exploration, Development and Leasing; Amend the CDCA Plan to have the HGLA Closed and Unavailable for Geothermal Exploration, Development and Leasing; Deny Authorization of All Pending Leases Within the HGLA

Under Alternative B, BLM-administered lands located within the HGLA would be closed to geothermal leasing, and the CDCA Plan would be amended to reflect that decision. Under this alternative the BLM would not offer competitive geothermal leases on any of the 22,805 acres of BLM-administered lands or federal mineral estate within the HGLA, and would deny the three pending non-competitive lease applications.

Alternative B would not result in any impacts to lands and realty issues because no geothermal development would occur within the HGLA, and no new surface ROW grants would be required.

Alternative C – Open the HGLA to Geothermal Exploration, Development and Leasing; with No Surface Occupancy (NSO) Allowed in Sensitive Areas; Amend the CDCA Plan to have the HGLA Open and Available for Geothermal Leasing; Authorize All Pending Leases within the HGLA

Under Alternative C, the CDCA Plan would be amended to reflect the delineated HGLA as open to geothermal leasing for direct and indirect use, but with specific acreages of the

HGLA under restrictions of the No Surface Occupancy (NSO) stipulation NSO-1. In addition, based on public concerns regarding the use and limited availability of groundwater, groundwater extraction for consumptive use would be prohibited. Under this alternative, the BLM would also authorize the three pending non-competitive lease applications for 4,277 acres.

The projected impacts under Alternative C would be similar to those discussed under Alternative A. In addition, Alternative C would also contain a NSO requirement which could result in less overlapping resource use in certain areas of this MUC L land.

Alternative D – Selective Closure of Sensitive Resource Areas within the HGLA for Geothermal Exploration and Development; Amend the CDCA Plan to have Designated Areas within the HGLA Open and Available for Geothermal Leasing; Amend the CDCA Plan to have Designated Areas within the HGLA Closed and Unavailable for Geothermal Leasing; Authorize All Pending Leases Within the HGLA

Under Alternative D, the BLM would close specific areas within the HGLA to geothermal leasing to protect sensitive resources while opening the remainder of the HGLA to leasing. Of the 22,805 acres of BLM managed lands or federal mineral estate within the HGLA, 13,773 acres would be closed and the remaining acres would be open in this alternative. In addition, based on public concerns regarding the use and limited availability of groundwater, groundwater extraction for consumptive use would be prohibited. The CDCA Plan would be amended to reflect the specific areas that are open and closed to geothermal exploration, development, and utilization. Under Alternative D, the BLM would also authorize the three modified pending non-competitive lease applications for 4,277 acres.

The projected impacts of Alternative D would be similar to those discussed under Alternatives A and C. In addition to recognizing existing authorized land uses, Alternative D would also close specific areas of the HGLA to geothermal leasing to further reduce overlapping resource demands.

Alternative E – No Action

Under the No Action Alternative, the CDCA Plan would not be amended, and the existing plan decisions, stipulations, and allocations would not change as a direct result of this EIS process. The HGLA would remain under management of the current CDCA Plan, which does not identify the HGLA as open or closed to geothermal leasing, nor does it indicate the availability status of lands within the HGLA. The three pending lease applications would be denied.

Alternative E would not result in any impacts to lands and realty issues because no geothermal development would occur within the HGLA under present CDCA Plan policies and guidelines.

4.12 PUBLIC HEALTH AND SAFETY

4.12.1 Methodology

4.12.1.1 Management Goals

The CDCA Plan does not establish specific management goals for public health and safety, or for the management of hazardous materials or wastes. However, the BLM's stated policy is to reduce threats to public health, safety, and property. In addition, in accordance with the FLPMA, the BLM is required to comply with applicable state standards for public health and safety. Moreover, the CDCA multiple-use classifications do not allow hazardous or non-hazardous waste disposal sites on public lands, except where authorized and landfills are suitable. Such public lands may be transferred to the appropriate owner/operator. The specific Multiple-Use Class L guidelines addressing waste disposal include:

- Hazardous waste disposal sites will not be allowed.
- New non-hazardous waste disposal sites will not be allowed

4.12.1.2 Impact Criteria

The potential impacts of geothermal exploration and development to public health and safety, and with regard to hazardous materials and waste, are assessed with respect to four criteria:

- Whether RFD actions create a hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials or wastes;
- Whether RFD actions create a hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment;
- Whether RFD actions emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one quarter mile of an existing or proposed school; or
- Whether RFD actions are located on a site which is included on a list of hazardous materials sites compiled by the federal or state government and, as a

result, would create a hazard to the public or the environment.

- Whether RFD actions, such as soil disturbance and geothermal emissions, add significant amounts of dust and chemical species (mercury, arsenic, antimony, alkalis for example) to the air that pose a threat to workers on-site and potentially result in increased deposition of these chemical species on the environment in population centers downwind of the project area.

The potential risks are ranked on a high-to-low risk scale as follows:

High

Potential impacts are ranked as high if significant impacts to the above criteria occurred;

Medium

Potential impacts are ranked as medium if moderate impacts to the above criteria occurred; and

Low

Potential impacts are ranked as low if minor or no impacts to the above criteria occurred.

4.12.2 Direct/Indirect Impacts

4.12.2.1 General Impacts

The potential hazardous and solid waste issues typically associated with geothermal exploration and development includes:

Exploration

Geothermal exploration activities have the potential for accidental drilling fluid or hydrocarbon spills, leakage from improperly constructed sump ponds or wastewater collection systems, improperly handled briny water from drilling, and accumulations of solid waste which could impact water quality or contaminate soils. Hydrocarbon spills could include hydraulic fluid, gasoline, oil, or grease from vehicles, generators, and exploratory drill rigs. Briny water from exploratory drilling, if improperly disposed, could raise the pH of discharges to hazardous levels. Accumulations of nonhazardous waste solids and liquids could include trash, drill cuttings, wastewater, bentonite, and cement generated during drilling operations.

Development

The public health and safety issues associated with the development phase of geothermal facilities are largely the same as described for the exploration phase, but the quantities are typically greater. In addition, stormwater runoff from well pads and plant facilities can

contain elevated quantities of heavy metals and volatile organic compounds. Substantial quantities of non-hazardous solid waste and liquids could also be generated, further increasing the potential for contamination of water, soil, and possible proving toxic to the biota. Health concerns from local air quality issues may stem from increased dust emissions or the introduction of hazardous materials to the environment. While the potential for exposure to on-site workers exists at geothermal facilities, that potential is expected to be minor if all appropriate stipulations and BMPs are applied.

Operation

Operation of geothermal generating facilities and wells present a long-term potential source for spills and leaks. Spilled or leaked materials could include hydraulic fluid, gasoline, oil, paint, antifreeze, cleaning solvents, transformer insulating fluid, binary fluids, and grease. Potential discharges could result in adverse impacts to water, soil, air, and the biota. Accidental releases from sumps or wastewater collection systems could include hazardous water-treatment chemicals such as chlorine. Stormwater runoff could contain elevated levels of heavy metals and volatile organic compounds. In addition, operation of these the two RFD facilities would likely generate substantial quantities of non-hazardous solid wastes.

Proper management of these substances consistent with federal and state solid and hazardous waste regulations would reduce or eliminate the potential for soil or water contamination, thus minimizing or avoiding adverse effects to worker health and safety, to the surrounding communities, or to the environmental resources of the HGLA. Potential impacts from the storage and handling of solid and hazardous wastes would be further minimized through adherence to lease stipulations and implementation of appropriate BMPs (see Appendix A). As such, the risk for potentially significant impacts involving hazardous materials would be ranked low.

4.12.2.2 Impacts by Alternative

Alternative A – Open the Entire HGLA for Geothermal Exploration, Development and Leasing; Amend the CDCA Plan to have the HGLA Open and Available for Geothermal Exploration, Development and Leasing; Authorize All Pending Leases Within the HGLA

Under Alternative A the CDCA Plan would be amended to reflect the delineated HGLA as open to geothermal leasing for direct and indirect use, and 22,805 acres of BLM-administered lands or federal mineral estate would be made available for geothermal exploration, development, and utilization. Groundwater extraction for consumptive use during exploration, development, and production would be allowed, but controlled or restricted by stipulation. Limited groundwater use may be allowed under certain conditions

specified in Chapter 2 and in SA-HGLA-10. Under this alternative the BLM would authorize the three pending non-competitive lease applications for 4,277 acres.

The foreseeable and potential impacts associated with Alternative A are discussed above. The impacts to public health and safety are expected to be low based on the terms and conditions of BLM's lease, and adherence to applicable construction stormwater pollution prevention and subsequent NPDES permit requirements. All hazardous materials as well as hazardous and solid wastes will be handled, stored, and disposed of consistent with applicable safety guidelines and regulatory requirements, and in compliance with the Multiple-Use Class L guidelines. In the event that future site-specific permitting studies would identify sensitive resources that warrant additional protection, the BLM would stipulate appropriate, project-specific mitigation measures.

Alternative B – Close the Entire HGLA to Geothermal Exploration, Development and Leasing; Amend the CDCA Plan to have the HGLA Closed and Unavailable for Geothermal Exploration, Development and Leasing; Deny Authorization of All Pending Leases Within the HGLA

Under Alternative B, BLM-administered lands located within the HGLA would be closed to geothermal leasing, and the CDCA Plan would be amended to reflect that decision. Under this alternative the BLM would not offer competitive geothermal leases on any of the 22,805 acres of BLM-administered lands or federal mineral estate within the HGLA, and would deny the three pending non-competitive lease applications.

Alternative B would not result in impacts to public health and safety because no geothermal development would occur within the HGLA.

Alternative C – Open the HGLA to Geothermal Exploration, Development and Leasing; with No Surface Occupancy (NSO) Allowed in Sensitive Areas; Amend the CDCA Plan to have the HGLA Open and Available for Geothermal Leasing; Authorize All Pending Leases within the HGLA

Under Alternative C, the CDCA Plan would be amended to reflect the delineated HGLA as open to geothermal leasing for direct and indirect use, but with specific acreages of the HGLA under restrictions of the No Surface Occupancy (NSO) stipulation NSO-HGLA-1. In addition, based on public concerns regarding the use and limited availability of groundwater, groundwater extraction for consumptive use would be prohibited. Under this alternative, the BLM would also authorize the three pending non-competitive lease applications for 4,277 acres.

The foreseeable and potential impacts associated with Alternative C are similar to those discussed for Alternative A. In addition to complying with existing laws, regulations, formal orders, and the terms and conditions of BLM's standard lease form Alternative C contains NSO requirements that may protect potentially sensitive resources or receptors. As such, the impacts to public health and safety under Alternative C are expected to be low.

Alternative D – Selective Closure of Sensitive Resource Areas within the HGLA for Geothermal Exploration and Development; Amend the CDCA Plan to have Designated Areas within the HGLA Open and Available for Geothermal Leasing; Amend the CDCA Plan to have Designated Areas within the HGLA Closed and Unavailable for Geothermal Leasing; Authorize All Pending Leases Within the HGLA

Under Alternative D, the BLM would close specific areas within the HGLA to geothermal leasing to protect sensitive resources while opening the remainder of the HGLA to leasing. Of the 22,805 acres of BLM managed lands or federal mineral estate within the HGLA, 13,773 acres would be closed and the remaining acres would be open in this alternative. In addition, based on public concerns regarding the use and limited availability of groundwater, groundwater extraction for consumptive use would be prohibited. The CDCA Plan would be amended to reflect the specific areas that are open and closed to geothermal exploration, development, and utilization. Under Alternative D, the BLM would also authorize the three modified pending non-competitive lease applications for 4,277 acres.

The foreseeable and potential impacts to public health and safety under Alternative D would be generally similar as those for Alternatives A and C. In addition to complying with existing laws, regulations, formal orders, and the terms and conditions of BLM's standard lease form, Alternative C closes specific areas of the HGLA which could provide additional protection of potentially sensitive resources or receptors. As such, the impacts to public health and safety under Alternative C are expected to be low.

Alternative E – No Action

Under the No Action Alternative, the CDCA Plan would not be amended, and the existing plan decisions, stipulations, and allocations would not change as a direct result of this EIS process. The HGLA would remain under management of the current CDCA Plan, which does not identify the HGLA as open or closed to geothermal leasing, nor does it indicate the availability status of lands within the HGLA. The three pending lease applications would be denied.

Alternative E would not result in any public health and safety impacts because no geothermal development would occur within the HGLA under present CDCA Plan policies and guidelines.

4.13 MINERAL RESOURCES

4.13.1 Methodology

4.13.1.1 Management Goals

The most applicable management goal of the CDCA Plan is the identification of potential sites for development of geothermal, wind, and solar generating facilities. The Plan's general goals for Geology-Energy-Minerals (G-E-M) resources are to:

- Within the multiple-use management framework, assure the availability of known mineral resource lands for exploration and development.
- Encourage the development of mineral resources in a manner which satisfies national and local needs and provides for economically and environmentally sound exploration, extraction, and reclamation processes.
- Develop a mineral resource inventory, G-E-M database, and professional, technical, and managerial staff knowledgeable in mineral exploration and development.

The Multiple-Use Class L management guidelines pertaining to leasable minerals state:

“Except as provided in Appendix 5.4, 516, DM 6, NEPA procedures titled “Categorical Exclusions”, prior to any lease, notice, or application that was filed pursuant to 43 CFR 3045, 3100, 3200, 3500, and S.O. 3087, as amended, an EA will be prepared on the proposed action. Mitigation and reclamation measures will be required to protect and rehabilitate sensitive scenic, ecological, wildlife, vegetative, and cultural values.”

4.13.1.2 Impact Criteria

The potential risk of geothermal development impacts on G-E-M resources is assessed with respect to one criterion. Potential adverse impacts could occur if RFD actions were to:

- Reduce or prevent exploration or recovery of important economic mineral

resources.

The potential risk of future impacts from geothermal exploration, development, production, or closeout is ranked on the following scale:

High

If there are significant impacts on the above criteria;

Medium

If there are moderate impacts on the above criteria; and

Low

If there are minor or no impacts on the above criteria.

4.13.2 Direct/Indirect Impacts

4.13.2.1 General Impacts

Mining, mineral material sites, unpatented mining claims, and abandoned mines exist in portions of some of the lease areas, and geothermal leases would be subject to valid existing rights. Both geothermal development and mining could be conducted in the same general area. The extent of their compatibility would depend on the nature of the mining operation and of the geothermal development. For example, pit mining or quarrying operations could interfere with siting of more permanent geothermal facilities (wells, pipelines, geothermal plants). Thus, geothermal development of an area could potentially restrict the ability to extract minerals.

Although the HGLA contains mineral resources, construction and operation of geothermal production plants is not expected to significantly affect access to or future development of these minerals or mineral production. In fact, geothermal exploration, including drilling deep wells, may have the beneficial impact of identifying additional, previously unrecognized, mineral deposits. There is a low potential risk for impacts on mineral resources.

4.13.2.2 Impacts by Alternative

Alternative A – Open the Entire HGLA for Geothermal Exploration, Development and Leasing; Amend the CDCA Plan to have the HGLA Open and Available for Geothermal Exploration, Development and Leasing; Authorize All Pending Leases Within the HGLA

Under Alternative A the CDCA Plan would be amended to reflect the delineated HGLA as open to geothermal leasing for direct and indirect use, and 22,805 acres of BLM-

administered lands or federal mineral estate would be made available for geothermal exploration, development, and utilization. Groundwater extraction for consumptive use during exploration, development, and production would be allowed, but controlled or restricted by stipulation. Limited groundwater use may be allowed under certain conditions specified in Chapter 2 and in SA-HGLA-10. Under this alternative the BLM would authorize the three pending non-competitive lease applications for 4,277 acres.

The foreseeable and potential impacts to mining operations in the HGLA under Alternative A are discussed above, and considered low. Future geothermal leases would be subject to existing rights, are not necessarily incompatible with mining, and would be subject to all applicable laws, regulations, formal orders, and the terms and conditions of BLM's standard lease form.

Alternative B – Close the Entire HGLA to Geothermal Exploration, Development and Leasing; Amend the CDCA Plan to have the HGLA Closed and Unavailable for Geothermal Exploration, Development and Leasing; Deny Authorization of All Pending Leases Within the HGLA

Under Alternative B, BLM-administered lands located within the HGLA would be closed to geothermal leasing, and the CDCA Plan would be amended to reflect that decision. Under this alternative the BLM would not offer competitive geothermal leases on any of the 22,805 acres of BLM-administered lands or federal mineral estate within the HGLA, and would deny the three pending non-competitive lease applications.

Alternative B would not result in any impacts to mining because no geothermal development would occur within the HGLA.

Alternative C – Open the HGLA to Geothermal Exploration, Development and Leasing; with No Surface Occupancy (NSO) Allowed in Sensitive Areas; Amend the CDCA Plan to have the HGLA Open and Available for Geothermal Leasing; Authorize All Pending Leases within the HGLA

Under Alternative C, the CDCA Plan would be amended to reflect the delineated HGLA as open to geothermal leasing for direct and indirect use, but with specific acreages of the HGLA under restrictions of the No Surface Occupancy (NSO) stipulation NSO-HGLA-1. In addition, based on public concerns regarding the use and limited availability of groundwater, groundwater extraction for consumptive use would be prohibited. Under this alternative, the BLM would also authorize the three pending non-competitive lease applications for 4,277 acres.

The foreseeable and potential impacts to mining operations in the HGLA under Alternative C are similar to those discussed under Alternative A, and considered low. Under Alternative C NSO requirements for part of the HGLA could further eliminate potential conflicts between mining operations and geothermal leasing.

Alternative D – Selective Closure of Sensitive Resource Areas within the HGLA for Geothermal Exploration and Development; Amend the CDCA Plan to have Designated Areas within the HGLA Open and Available for Geothermal Leasing; Amend the CDCA Plan to have Designated Areas within the HGLA Closed and Unavailable for Geothermal Leasing; Authorize All Pending Leases Within the HGLA

Under Alternative D, the BLM would close specific areas within the HGLA to geothermal leasing to protect sensitive resources while opening the remainder of the HGLA to leasing. Of the 22,805 acres of BLM managed lands or federal mineral estate within the HGLA, 13,773 acres would be closed and the remaining acres would be open in this alternative. In addition, based on public concerns regarding the use and limited availability of groundwater, groundwater extraction for consumptive use would be prohibited. The CDCA Plan would be amended to reflect the specific areas that are open and closed to geothermal exploration, development, and utilization. Under Alternative D, the BLM would also authorize the three modified pending non-competitive lease applications for 4,277 acres.

The foreseeable and potential impacts to mining operations in the HGLA under Alternative D are similar to those discussed for Alternative A. Under Alternative D portions of the HGLA would be closed which could further eliminate potential conflicts between mining operations and geothermal leasing.

Alternative E – No Action

Under the No Action Alternative, the CDCA Plan would not be amended, and the existing plan decisions, stipulations, and allocations would not change as a direct result of this EIS process. The HGLA would remain under management of the current CDCA Plan, which does not identify the HGLA as open or closed to geothermal leasing, nor does it indicate the availability status of lands within the HGLA. The three pending lease applications would be denied.

Alternative E would not result in any impacts to mining because no geothermal development would occur within the HGLA under present CDCA Plan policies and guidelines.

4.14 WILD HORSES AND BURROS

4.14.1 Methodology

4.14.1.1 *Management Goals*

The CDCA Plan provides overall management direction for all public lands in the CDCA. The CDCA Plan's Wild Horse and Burro Element lists the following goals:

- Provide for the year-long food requirements of wild horses and burros by reserving sufficient forage to meet the biological requirements of a specified number of animals.
- Provide adequate cover for wild horses and burros by maintaining free access to existing cover for these animals. Attainment of this objective would be consistent with the need to restrict wild horse and burro use from selected riparian areas, when required to protect other resource values.
- Provide adequate water to meet the year-long requirements of wild horses and burros by improving existing waters, developing new waters, and developing alternative waters when wild horses and burros must be excluded from existing water.
- Provide adequate living space for wild horses and burros by designing new structures or modifying existing structures in such a manner as to allow for the normal distribution and movement patterns of these animals. The key to attainment of this objective is preservation of the home ranges established by a majority of wild horses and burros by use of individual Herd Management Areas (HMAs). Attainment of this objective would be consistent with the need to restrict wild horse and burro access in selected areas in order to protect other resource values, and specifically to manage burros so that they do not jeopardize the continued existence and welfare of bighorn sheep.
- Protect wild horses and burros on public lands by conducting surveillance to prevent unauthorized removal or undue harassment of the animals.

The corresponding Multiple-Use Class L guidelines addressing wild horses and burros state:

- Populations of wild and free-roaming horses and burros will be maintained in healthy, stable herds, in accordance with the Wild and Free-Roaming Horse and Burro's Act of 1971, but will be subject to controls to protect sensitive resources.

The CDCA Plan established 17 Herd Management Areas (HMAs) within the CDCA where populations of wild horses and burros are managed and protected. Moreover, the Wild Free-Roaming Horses and Burros Act of 1971 dictates that the BLM has the responsibility to protect, manage, and control wild horses and burros. As such, appropriate stipulations and mitigation measures may be applied on a case-by-case basis to leases where direct and indirect geothermal resource development may impact these species.

4.14.1.2 Impact Criteria

Potential impacts to wild horses and burros from exploration and geothermal development in the HGLA are assessed with respect to two criteria:

- Do the RFD actions have an adverse effect on the habitat of wild horses and burros? and
- Do the RFD actions interfere with the movement of wild horses and burros?

The potential risks to wild horses and burros from geothermal exploration, development, production, or closeout are ranked from high-to-low as follows:

High

If there are significant impacts to the above criteria;

Medium

If there are moderate impacts to the above criteria; and

Low

If there are minor or no impacts to the above criteria.

4.14.2 Direct/Indirect Impacts

4.14.2.1 General Impacts

The noise and human presence connected with geothermal exploration, development, and utilization can influence herd distribution and movements within the Centennial HMA. In response, wild horses and burros would likely shift their movements to avoid disturbances. However, it should be noted that there are no natural perennial waters in the HGLA that the animals are dependent upon, and their occurrence has been reported primarily from portions of the China Lake NAWS. As such, wild horses and burros may utilize the southeastern portion of the HGLA during portions of winter and spring when ephemeral water is available and ephemeral plants provide forage. Based on their general absence or, at best, seasonal use

of a portion of the HGLA, the impacts from the Haiwee RFD scenario on the movement of wild horses and burros is expected to be low.

The potential for indirect impacts to the wild horse and burro population would be minimized through compliance with State and federal regulations, adherence to lease stipulations, and implementation of appropriate BMPs (Appendix A). Recommended BMPs for this resource include:

- The operator will ensure employees, contractors, and site visitors avoid harassment and disturbance of wild horses and burros, especially during reproductive (e.g., breeding and birthing) seasons. If wild horses or burros are encountered throughout the operation during transport of materials, the driver will reduce speed or stop as necessary to avoid frightening the animals. Harassment of wild horses and burros is a criminal offense and punishable under 43 CFR 4770.5. In addition, any pets will be controlled to avoid harassment and disturbance of wild horses and burros.
- Ponds, tanks and impoundments containing harmful liquids will be excluded from wildlife access by fencing, netting or covering at all times when not in active use. Water ponds or other means of water that normally would not be there in a natural setting shall be fenced off to preclude wild horses and burros access.

Observations of potential problems regarding wild horses or burros, including animal mortality, will be immediately reported to the appropriate agencies.

4.14.2.2 Impacts by Alternative

Alternative A – Open the Entire HGLA for Geothermal Exploration, Development and Leasing; Amend the CDCA Plan to have the HGLA Open and Available for Geothermal Exploration, Development and Leasing; Authorize All Pending Leases Within the HGLA

Under Alternative A the CDCA Plan would be amended to reflect the delineated HGLA as open to geothermal leasing for direct and indirect use, and 22,805 acres of BLM-administered lands or federal mineral estate would be made available for geothermal exploration, development, and utilization. Groundwater extraction for consumptive use during exploration, development, and production would be allowed, but controlled or restricted by stipulation. Limited groundwater use may be allowed under certain conditions specified in Chapter 2 and in SA-HGLA-10. Under this alternative the BLM would authorize the three pending non-competitive lease applications for 4,277 acres.

The foreseeable and potential impacts to wild horses and burros under Alternative A are discussed above. The anticipated impacts under Alternative A are expected to be low due to

their status of occurrence on the HGLA, and adherence of all geothermal exploration, development, and operation activities to applicable laws, regulations, formal orders, and the terms and conditions of BLM's standard lease form. In the event that future site-specific permitting studies would identify the presence of these animals, or of sensitive resources like water sources, the BLM would stipulate appropriate, project-specific mitigation measures to protect these species.

Alternative B – Close the Entire HGLA to Geothermal Exploration, Development and Leasing; Amend the CDCA Plan to have the HGLA Closed and Unavailable for Geothermal Exploration, Development and Leasing; Deny Authorization of All Pending Leases Within the HGLA

Under Alternative B, BLM-administered lands located within the HGLA would be closed to geothermal leasing, and the CDCA Plan would be amended to reflect that decision. Under this alternative the BLM would not offer competitive geothermal leases on any of the 22,805 acres of BLM-administered lands or federal mineral estate within the HGLA, and would deny the three pending non-competitive lease applications.

Alternative B would not result in any impacts to wild horses and burros because no geothermal development would occur within the HGLA.

Alternative C – Open the HGLA to Geothermal Exploration, Development and Leasing; with No Surface Occupancy (NSO) Allowed in Sensitive Areas; Amend the CDCA Plan to have the HGLA Open and Available for Geothermal Leasing; Authorize All Pending Leases within the HGLA

Under Alternative C, the CDCA Plan would be amended to reflect the delineated HGLA as open to geothermal leasing for direct and indirect use, but with specific acreages of the HGLA under restrictions of the No Surface Occupancy (NSO) stipulation NSO-HGLA-1. In addition, based on public concerns regarding the use and limited availability of groundwater, groundwater extraction for consumptive use would be prohibited. Under this alternative, the BLM would also authorize the three pending non-competitive lease applications for 4,277 acres.

The foreseeable and potential impacts to wild horses and burros under Alternative C are similar to those discussed under Alternative A, above. Under Alternative C wild horses and burros, or their watering areas and other key habitat features, would be further protected in the areas of NSO. Impacts under Alternative C are expected to be low based on these options, on the status of wild horses and burros on the HGLA, and adherence of geothermal

exploration, development, and operation activities to applicable laws, regulations, formal orders, and the terms and conditions of BLM's standard lease form.

Alternative D – Selective Closure of Sensitive Resource Areas within the HGLA for Geothermal Exploration and Development; Amend the CDCA Plan to have Designated Areas within the HGLA Open and Available for Geothermal Leasing; Amend the CDCA Plan to have Designated Areas within the HGLA Closed and Unavailable for Geothermal Leasing; Authorize All Pending Leases Within the HGLA

Under Alternative D, the BLM would close specific areas within the HGLA to geothermal leasing to protect sensitive resources while opening the remainder of the HGLA to leasing. Of the 22,805 acres of BLM managed lands or federal mineral estate within the HGLA, 13,773 acres would be closed and the remaining acres would be open in this alternative. In addition, based on public concerns regarding the use and limited availability of groundwater, groundwater extraction for consumptive use would be prohibited. The CDCA Plan would be amended to reflect the specific areas that are open and closed to geothermal exploration, development, and utilization. Under Alternative D, the BLM would also authorize the three modified pending non-competitive lease applications for 4,277 acres.

The foreseeable and potential impacts to wild horses and burros under Alternative D are similar to those discussed under Alternatives A and C, above. Impacts under Alternative D are expected to be low based on the closure of part of the HGLA, on the status of wild horses and burros on the HGLA, and adherence of geothermal exploration, development, and operation activities to applicable laws, regulations, formal orders, and the terms and conditions of BLM's standard lease form.

Alternative E – No Action

Under the No Action Alternative, the CDCA Plan would not be amended, and the existing plan decisions, stipulations, and allocations would not change as a direct result of this EIS process. The HGLA would remain under management of the current CDCA Plan, which does not identify the HGLA as open or closed to geothermal leasing, nor does it indicate the availability status of lands within the HGLA. The three pending lease applications would be denied.

Alternative E would not result in any impacts to wild horses and burros because no geothermal development would occur within the HGLA under present CDCA Plan policies and guidelines.

4.15 GRAZING

4.15.1 Methodology

4.15.1.1 Management Goals

The FLPMA and the Public Rangelands Improvement Act of 1978 recognize livestock grazing as a principal use of public lands for the production of food and fiber, and the BLM manages livestock grazing through grazing allotments that are leased to cattle and sheep interests. The specific goals of the Livestock Grazing Element of the CDCA Plan are:

- Continue the use of the California Desert for livestock production to continue to satisfying the need for food and fiber from public land.
- Use livestock grazing as a tool to change or improve vegetation for meeting livestock needs as well as other management objectives as set forth in the Plan.
- Maintain lands that are in good to excellent condition at these production levels. Those lands in poor to fair condition will be improved by the application of appropriate management prescriptions to regulate livestock grazing within the framework of multiple use and sustained yield.
- Improve vegetation use by improving distribution of livestock through the use of range improvements and specific management prescriptions which will be fully developed and implemented with Allotment Management Plans (AMPS).
- Conduct specific monitoring procedures of condition and trend to determine the necessary grazing adjustments to meet management goals.

The corresponding Multiple-Use Class L management guidelines pertaining to livestock grazing state:

- Grazing will be allowed subject to the protection of sensitive resources. Support facilities such as corrals, loading chutes, water developments, and other facilities, permanent or temporary, may be allowed consistent with protection of sensitive resources.
- Manipulation of vegetation by chemical or mechanical means will not be allowed, except for site-specific needs.

4.15.1.2 Impact Criteria

Potential geothermal development impacts to grazing resources could occur if implementation of the Haiwee RFD scenario was to result in a loss of more than 10 percent of the AUMs supported by a given allotment.

The corresponding impact risks are ranked on a high-to-low risk scale.

High

If the action results in significantly higher losses than 10 percent of the AUMs;

Medium

If the action results in moderately higher losses than 10 percent of the AUMs; and

Low

If grazing losses are 10 percent or less of the AUMs.

4.15.2 Direct/Indirect Impacts

4.15.2.1 General Impacts

The entire HGLA is subject to grazing permits. The potential impacts to livestock grazing from geothermal exploration, development, and utilization could include temporary disturbance from construction activities, loss of vegetation that would temporarily decrease the amount of available forage for livestock, and disruption of livestock movement. Based upon the Haiwee RFD scenario, up to 384 acres of grazing lands would be temporarily impacted, followed by the long-term loss of 276 acres following initial reclamation. Exploration activities could also have a temporary effect on grazing patterns by shifting and/or intensifying livestock grazing over other areas, potentially resulting in impacts to native vegetation and wildlife in areas outside the authorized grazing areas.

Alternative A – Open the Entire HGLA for Geothermal Exploration, Development and Leasing; Amend the CDCA Plan to have the HGLA Open and Available for Geothermal Exploration, Development and Leasing; Authorize All Pending Leases Within the HGLA

Under Alternative A the CDCA Plan would be amended to reflect the delineated HGLA as open to geothermal leasing for direct and indirect use, and 22,805 acres of BLM-administered lands or federal mineral estate would be made available for geothermal exploration, development, and utilization. Groundwater extraction for consumptive use during exploration, development, and production would be allowed, but controlled or restricted by stipulation. Limited groundwater use may be allowed under certain conditions

specified in Chapter 2 and in SA-HGLA-10. Under this alternative the BLM would authorize the three pending non-competitive lease applications for 4,277 acres.

The foreseeable and potential impacts to grazing privileges under Alternative A are discussed above, and are considered low. The degree of actual impacts would depend on the locations of future RFD facilities. The potential 384 acres reduction in available grazing lands could be distributed through two existing grazing allotments (Tunawee Common and Lacey-Cactus-McCloud) that overlap the HGLA. There is 2,408 acres (four percent) of the Tunawee Common Grazing Allotment, and 1,449 acres (three percent) of the Lacey-Cactus-McCloud Grazing Allotment, overlap with the three pending noncompetitive lease application areas CACA-043993, CACA-043998 and CACA-044082. If the Haiwee RFD scenario would be fully implemented, future geothermal development would result in the disturbance and loss of access to 384 grazing acres, or less than one percent of each of the allotments.

It should be noted that, under BLM regulations, grazing allotment permits are held subject to other uses of the public lands. If the BLM approves other (non-emergency) uses that would limit grazing within existing allotments, the BLM issues the permit holders two years notice of the planned reduction in the allotment. Since even at full build-out BLM's RFD scenario would disturb only a small percentage of acreage within the allotments, the impacts of Alternative A on the grazing resources with the Tunawee Common and Lacey-Cactus-McCloud grazing allotments are considered low. At full build-out the Haiwee RFD facilities would only occupy approximately one percent of the HGLA. In the event that future geothermal activities or facilities would result in potential conflicts with existing grazing privileges, the BLM would stipulate appropriate, project-specific onsite mitigation measures.

Alternative B – Close the Entire HGLA to Geothermal Exploration, Development and Leasing; Amend the CDCA Plan to have the HGLA Closed and Unavailable for Geothermal Exploration, Development and Leasing; Deny Authorization of All Pending Leases Within the HGLA

Under Alternative B, BLM-administered lands located within the HGLA would be closed to geothermal leasing, and the CDCA Plan would be amended to reflect that decision. Under this alternative the BLM would not offer competitive geothermal leases on any of the 22,805 acres of BLM-administered lands or federal mineral estate within the HGLA, and would deny the three pending non-competitive lease applications.

Alternative B would not result in any impacts to grazing on the HGLA because no geothermal development would occur within the HGLA.

Alternative C – Open the HGLA to Geothermal Exploration, Development and Leasing; with No Surface Occupancy (NSO) Allowed in Sensitive Areas; Amend the CDCA Plan to have the HGLA Open and Available for Geothermal Leasing; Authorize All Pending Leases within the HGLA

Under Alternative C, the CDCA Plan would be amended to reflect the delineated HGLA as open to geothermal leasing for direct and indirect use, but with specific acreages of the HGLA under restrictions of the No Surface Occupancy (NSO) stipulation NSO-HGLA-1. In addition, based on public concerns regarding the use and limited availability of groundwater, groundwater extraction for consumptive use would be prohibited. Under this alternative, the BLM would also authorize the three pending non-competitive lease applications for 4,277 acres, and offer competitive leases for the approximately 18,000 acre balance of BLM-administered lands.

The foreseeable and potential impacts to grazing privileges under Alternative C are similar to those discussed under Alternative A. Although not expected to be an issue since grazing privileges are held subject to other authorized uses, Alternative C contains NSO requirements for specific areas of the HGLA, which could resolve potential conflicts between existing grazing privileges and future geothermal leases and activities.

Alternative D – Selective Closure of Sensitive Resource Areas within the HGLA for Geothermal Exploration and Development; Amend the CDCA Plan to have Designated Areas within the HGLA Open and Available for Geothermal Leasing; Amend the CDCA Plan to have Designated Areas within the HGLA Closed and Unavailable for Geothermal Leasing; Authorize All Pending Leases Within the HGLA

Under Alternative D, the BLM would close specific areas within the HGLA to geothermal leasing to protect sensitive resources while opening the remainder of the HGLA to leasing. Of the 22,805 acres of BLM managed lands or federal mineral estate within the HGLA, 13,773 acres would be closed and the remaining acres would be open in this alternative. In addition, based on public concerns regarding the use and limited availability of groundwater, groundwater extraction for consumptive use would be prohibited. The CDCA Plan would be amended to reflect the specific areas that are open and closed to geothermal exploration, development, and utilization. Under Alternative D, the BLM would also authorize the three modified pending non-competitive lease applications for 4,277 acres.

The foreseeable and potential impacts to grazing privileges under Alternative D would be generally similar as those discussed for Alternatives A and C. However, Alternative D could reduce potential impacts to existing grazing privileges in the areas that are closed to leasing.

Alternative E – No Action

Under the No Action Alternative, the CDCA Plan would not be amended, and the existing plan decisions, stipulations, and allocations would not change as a direct result of this EIS process. The HGLA would remain under management of the current CDCA Plan, which does not identify the HGLA as open or closed to geothermal leasing, nor does it indicate the availability status of lands within the HGLA. The three pending lease applications would be denied.

Alternative E would not result in any impacts to grazing privileges because no geothermal development would occur within the HGLA under present CDCA Plan policies and guidelines.

4.16 RECREATION

4.16.1 Methodology

4.16.1.1 Management Goals

The CDCA Plan's Recreation Element lists the following goals:

- Provide a wide range of opportunities within resource capabilities for engaging in recreational activities for all desert users.
- Provide recreational management and facilities consistent with sound visitor and resource protection practices, with emphasis on conserving desert resources that have special scenic, historic, scientific, or recreational values.
- Protect desert users and minimize conflicts among recreationists and users of other desert resources.
- Enhance the enjoyment of the recreation experience and aid resource protection by increasing understanding and knowledge of the California Desert's resources and uses. Pursue this goal through public involvement in volunteer efforts, interpretation and environmental education programs, community outreach efforts, and other programs.

- Monitor and evaluate visitor use and preferences and adjust BLM programs to meet changing needs where appropriate.
- Provide for off-road-vehicle recreation use where appropriate in conformance with FLPMA, Section 601, and Executive Orders 11644 and 11989.

The corresponding relevant Multiple-Use Class L management guidelines for recreation state:

- This class is suitable for recreation which generally involves low to moderate user densities. Recreation opportunities include land sailing in dry lakes and non-competitive vehicle touring and events only on “approved” routes of travel.

4.16.1.2 Impact Criteria

The potential impacts from exploration and geothermal development to the recreational resources within the HGLA and vicinity are assessed with respect to two criteria. Potential impacts to recreation could occur if RFD actions were to:

- Increase the use of neighborhood and regional parks or other recreational facilities such that the facility would substantially deteriorate or that deterioration would be accelerated; or
- Diminish the enjoyment of existing recreational opportunities.

The potential risks of impacts are ranked on a high-to-low scale:

High

If there are significant impacts on the above criteria;

Medium

If there are moderate impacts on the above criteria; and

Low

If there are minor or no impacts on the above criteria.

4.16.2 Direct/Indirect Impacts

4.16.2.1 General Impacts

This section describes the potential impacts to recreational resources and programs associated with the Haiwee RFD scenario. These potential impacts are assessed with respect to the goals of the Recreation Element of the CDCA Plan stated above.

Recreational resources are valued for the opportunity to participate in outdoor recreation activities in a natural, scenic setting. Geothermal leasing could result in a reduction in the amount of land available for recreational use, and in the diminishment of users' recreational experiences on lands that remain open for recreation. Noise, vibration, dust, visual impacts, and odor from geothermal energy exploration, development, and operations, could disrupt the recreational enjoyment of the area. Similarly, views of construction equipment, or the addition or change of industrial structures such as pipelines, power lines, and generating facilities conflict with the natural background of many of these recreational resources, and lead to a low to medium, long-term aesthetic impact.

Intermittent noise associated with construction, visual impacts, and the temporary loss of access for recreational use during the exploration phase could result in a low risk of a significant and temporary impact on the recreational experiences available within the HGLA and vicinity.

Geothermal development including construction of well pads and wells, storage yards and staging areas, geothermal plants and associated transmission and pipelines lines as well as roads could also temporarily limit the amount of land available for OHV use, driving for pleasure, hiking, photography, rockhounding, hunting, primitive camping, dual sport motorcycle and equestrian events, rock climbing, and wildlife viewing. During certain phases of construction (i.e., pipeline construction), access via designated routes of travel may require use of alternate routes for short periods of time. Signage and public notices concerning such temporary route closures would serve to reduce conflicts with recreational users by directing them to areas unaffected during these construction periods.

Most OHV vehicles gain access to the HGLA via Gill Station Road and various unimproved roads. Geothermal development in the area is not expected to significantly restrict or reduce access to public lands with OHVs.

4.16.2.2 Impacts by Alternative

Alternative A – Open the Entire HGLA for Geothermal Exploration, Development and Leasing; Amend the CDCA Plan to have the HGLA Open and Available for Geothermal Exploration, Development and Leasing; Authorize All Pending Leases Within the HGLA

Under Alternative A the CDCA Plan would be amended to reflect the delineated HGLA as open to geothermal leasing for direct and indirect use, and 22,805 acres of BLM-administered lands or federal mineral estate would be made available for geothermal exploration, development, and utilization. Groundwater extraction for consumptive use during exploration, development, and production would be allowed, but controlled or restricted by stipulation. Limited groundwater use may be allowed under certain conditions specified in Chapter 2 and in SA-HGLA-10. Under this alternative the BLM would authorize the three pending non-competitive lease applications for 4,277 acres.

Opening the HGLA to geothermal development would require a long-term commitment of up to 276 acres of BLM, state, and private lands, which would subsequently become unavailable for recreational uses for the life of the geothermal leases.

Alternative A would likely impact dispersed recreational opportunities in the immediate vicinity of land disturbance activities. The primary effect would be the change of the recreational experience on larger scale activities such as OHV use of existing roads in the area. Short-term impacts to recreation within the HGLA could primarily result from all phases of the construction process. Activities associated with the upgrade of existing roads, construction of new roads and well pad sites, and setup of the well rigs could temporarily alter use of roads for the duration of the construction activities. Conflicts with recreational users could occur when construction vehicles travel to and from construction sites. Construction vehicles would be parked off-road in designated staging areas to minimize conflicts with access to recreation areas during construction. Where possible, based on the locations of suitable geothermal resources, the siting of construction sites will be located away from designated recreational routes of travel to minimize conflicts with other users of public lands. Since cross country travel is not permitted on the BLM-managed portion of the HGLA, only designated routes of travel would be potentially affected. The development of new roads could also increase public land access, and generate additional roads and trails in previously un-roaded landscapes.

Due to the temporary nature of construction activities, the relatively small number of people who use the area, and availability of adjacent alternative areas, the effects of the proposed action on the recreational resources would not be considered significant. In addition, there are no parks or other Federal, State, or county facilities in the immediate area. It is not anticipated that the recreational experience and use of the Coso Range Wilderness Area, would be significantly affected. This wilderness area is located approximately one mile north-east of the HGLA.

Under the full RFD scenario, the geothermal facilities would cause the long-term loss of up to 276 acres of land, or approximately one percent of the total HGLA. With the inclusion of

the BMPs described in Appendix A, the anticipated impacts to recreation resources would be mitigated to the greatest extent feasible. The resulting degree of impact is judged to be low to medium.

Alternative B – Close the Entire HGLA to Geothermal Exploration, Development and Leasing; Amend the CDCA Plan to have the HGLA Closed and Unavailable for Geothermal Exploration, Development and Leasing; Deny Authorization of All Pending Leases Within the HGLA

Under Alternative B, BLM-administered lands located within the HGLA would be closed to geothermal leasing, and the CDCA Plan would be amended to reflect that decision. Under this alternative the BLM would not offer competitive geothermal leases on any of the 22,805 acres of BLM-administered lands or federal mineral estate within the HGLA, and would deny the three pending non-competitive lease applications.

Alternative B would not result in any recreational impacts because no geothermal development would occur within the HGLA.

Alternative C – Open the HGLA to Geothermal Exploration, Development and Leasing; with No Surface Occupancy (NSO) Allowed in Sensitive Areas; Amend the CDCA Plan to have the HGLA Open and Available for Geothermal Leasing; Authorize All Pending Leases within the HGLA

Under Alternative C, the CDCA Plan would be amended to reflect the delineated HGLA as open to geothermal leasing for direct and indirect use, but with specific acreages of the HGLA under restrictions of the No Surface Occupancy (NSO) stipulation NSO-HGLA-1. In addition, based on public concerns regarding the use and limited availability of groundwater, groundwater extraction for consumptive use would be prohibited. Under this alternative, the BLM would also authorize the three pending non-competitive lease applications for 4,277 acres, and offer competitive leases for the approximately 18,000 acre balance of BLM-administered lands.

The foreseeable and potential impacts to recreational activities in the HGLA under Alternative C would be similar to those described under Alternative A. However, Alternative C has NSO requirements for some areas which could reduce potential conflict between recreational and geothermal activities. Although dependent on the specific locations of the Haiwee RFD facilities, the impacts under Alternative C are considered low.

Alternative D – Selective Closure of Sensitive Resource Areas within the HGLA for Geothermal Exploration and Development; Amend the CDCA Plan to have Designated Areas within the HGLA Open and Available for Geothermal Leasing; Amend the CDCA Plan to have Designated Areas within the HGLA Closed and Unavailable for Geothermal Leasing; Authorize All Pending Leases Within the HGLA

Under Alternative D, the BLM would close specific areas within the HGLA to geothermal leasing to protect sensitive resources while opening the remainder of the HGLA to leasing. Of the 22,805 acres of BLM managed lands or federal mineral estate within the HGLA, 13,773 acres would be closed and the remaining acres would be open in this alternative. In addition, based on public concerns regarding the use and limited availability of groundwater, groundwater extraction for consumptive use would be prohibited. The CDCA Plan would be amended to reflect the specific areas that are open and closed to geothermal exploration, development, and utilization. Under Alternative D, the BLM would also authorize the three modified pending non-competitive lease applications for 4,277 acres.

The foreseeable and potential impacts to recreational activities in the HGLA under Alternative D would be similar to those described under Alternatives A and C. However, Alternative D closes part of the HGLA which could resolve potential conflicts between recreational and geothermal activities. The impacts under Alternative D are considered low.

Alternative E – No Action

Under the No Action Alternative, the CDCA Plan would not be amended, and the existing plan decisions, stipulations, and allocations would not change as a direct result of this EIS process. The HGLA would remain under management of the current CDCA Plan, which does not identify the HGLA as open or closed to geothermal leasing, nor does it indicate the availability status of lands within the HGLA. The three pending lease applications would be denied.

Alternative E would not result in any recreational impacts because no geothermal development would occur within the HGLA under present CDCA Plan policies and guidelines.

4.17 AREAS OF SPECIAL DESIGNATION

4.17.1 Methodology

4.17.1.1 Management Goals

The goals of the Areas of Critical Environmental Concern (ACEC) Program are to:

- Identify and protect the significant natural and cultural resources requiring special management attention found on the BLM-administered lands in the CDCA;
- Provide for other uses in the designated areas, compatible with the protection and enhancement of the significant natural and cultural resources; and
- Systematically monitor the preservation of the significant natural and cultural resources on BLM-administered lands, and the compatibility of other allowed uses with these resources.

4.17.1.2 Impact Criteria

Potential impacts associated with the Haiwee RFD scenario are analyzed in the context of the degree to which they have:

- Conflict with management goals and objectives set forth by the BLM in order to categorize, protect, and manage special designation areas;
- Conflict with conservation goals for the area; or
- Result in proposed land uses that are incompatible with existing or adjacent special designated areas.

4.17.2 Direct/Indirect Impacts

4.17.2.1 General Impacts

Congressionally-designated areas are typically withdrawn from geothermal development. Administrative designations are not automatically withdrawn from geothermal development; however, activities likely to affect the resources and values identified for protection under these designations would be precluded.

According to the CDCA Plan/West Mojave Plan, the Rose Spring ACEC is located on BLM Multiple Use Class (MUC) public lands (Class L). MUC Class L protects sensitive, natural, scenic, ecological, and cultural resource values. Lands within the WEMO area that are designated as MUC Class L are “managed to provide for generally lower-intensity, carefully controlled multiple use of resources, while ensuring that sensitive values are not significantly diminished.” For MUC Class L lands, geothermal electrical generation facilities may be allowed pursuant to licenses issued under 43 CFR Section 3250, et seq., and after NEPA requirements are met.

4.17.2.2 Impacts by Alternative

Alternative A – Open the Entire HGLA for Geothermal Exploration, Development and Leasing; Amend the CDCA Plan to have the HGLA Open and Available for Geothermal Exploration, Development and Leasing; Authorize All Pending Leases Within the HGLA

Under Alternative A the CDCA Plan would be amended to reflect the delineated HGLA as open to geothermal leasing for direct and indirect use, and 22,805 acres of BLM-administered lands or federal mineral estate would be made available for geothermal exploration, development, and utilization. Groundwater extraction for consumptive use during exploration, development, and production would be allowed, but controlled or restricted by stipulation. Limited groundwater use may be allowed under certain conditions specified in Chapter 2 and in SA-HGLA-10. Under this alternative the BLM would authorize the three pending non-competitive lease applications for 4,277 acres.

The foreseeable and potential impacts to areas of special designation under Alternative A are rated low. The potential for impacts to the Rose Spring ACEC will be determined in future NEPA assessments and permitting studies for site- and project-specific proposals. An area such as the Rose Spring ACEC, along with a sufficiently large buffer zone, would be protected from development and adverse impacts, either via responsible siting or by stipulation. Leases issued under Alternative A would have the appropriate stipulations, conditions of approval, and BMPs to minimize impacts to special designated areas. As such the effects of geothermal exploration, development, utilization, and ultimate reclamation on Rose Spring ACEC would be expected to have no adverse impacts.

Alternative B – Close the Entire HGLA to Geothermal Exploration, Development and Leasing; Amend the CDCA Plan to have the HGLA Closed and Unavailable for Geothermal Exploration, Development and Leasing; Deny Authorization of All Pending Leases Within the HGLA

Under Alternative B, BLM-administered lands located within the HGLA would be closed to geothermal leasing, and the CDCA Plan would be amended to reflect that decision. Under this alternative the BLM would not offer competitive geothermal leases on any of the 22,805 acres of BLM-administered lands or federal mineral estate within the HGLA, and would deny the three pending non-competitive lease applications.

Alternative B would not result in any impacts to special designated areas because no geothermal development would occur within the HGLA.

Alternative C – Open the HGLA to Geothermal Exploration, Development and Leasing; with No Surface Occupancy (NSO) Allowed in Sensitive Areas; Amend the CDCA Plan to have the HGLA Open and Available for Geothermal Leasing; Authorize All Pending Leases within the HGLA

Under Alternative C, the CDCA Plan would be amended to reflect the delineated HGLA as open to geothermal leasing for direct and indirect use, but with specific acreages of the HGLA under restrictions of the No Surface Occupancy (NSO) stipulation NSO-HGLA-1. In addition, based on public concerns regarding the use and limited availability of groundwater, groundwater extraction for consumptive use would be prohibited. Under this alternative, the BLM would also authorize the three pending non-competitive lease applications for 4,277 acres, and offer competitive leases for the approximately 18,000 acre balance of BLM-administered lands.

The foreseeable and potential impacts to areas of special designation associated with Alternative C would be generally similar as those for Alternative A. However, Alternative C contains NSO requirements which will limit or avoid geothermal lease impacts to the Rose Spring ACEC. As such, no impacts to areas of special designations under Alternative C are expected.

Alternative D – Selective Closure of Sensitive Resource Areas within the HGLA for Geothermal Exploration and Development; Amend the CDCA Plan to have Designated Areas within the HGLA Open and Available for Geothermal Leasing; Amend the CDCA Plan to have Designated Areas within the HGLA Closed and Unavailable for Geothermal Leasing; Authorize All Pending Leases Within the HGLA

Under Alternative D, the BLM would close specific areas within the HGLA to geothermal leasing to protect sensitive resources while opening the remainder of the HGLA to leasing. Of the 22,805 acres of BLM managed lands or federal mineral estate within the HGLA, 13,773 acres would be closed and the remaining acres would be open in this alternative. In addition, based on public concerns regarding the use and limited availability of groundwater, groundwater extraction for consumptive use would be prohibited. The CDCA Plan would be amended to reflect the specific areas that are open and closed to geothermal exploration, development, and utilization. Under Alternative D, the BLM would also authorize the three modified pending non-competitive lease applications for 4,277 acres.

Alternative D would close specific areas of the HGLA to geothermal leasing to limit or avoid geothermal lease impacts to the Rose Spring ACEC. As such, no impacts to Rose Spring would be expected under Alternative D.

Alternative E – No Action

Under the No Action Alternative, the CDCA Plan would not be amended, and the existing plan decisions, stipulations, and allocations would not change as a direct result of this EIS process. The HGLA would remain under management of the current CDCA Plan, which does not identify the HGLA as open or closed to geothermal leasing, nor does it indicate the availability status of lands within the HGLA. The three pending lease applications would be denied.

Alternative E would not result in any impacts to special designated areas because no geothermal development would occur within the HGLA under present CDCA Plan policies and guidelines.

4.18 TRAFFIC/TRANSPORTATION

4.18.1 Methodology

4.18.1.1 Management Goals

The CDCA Plan's Motorized Vehicle Access Element seeks to manage motorized vehicle access on public lands, and designate areas for appropriate vehicle access. To these ends, the CDCA Plan seeks to constrain access to balance public and private needs, to avoid adverse impacts to desert resources, and to use maps, signs, and published information to alert users to motorized vehicle access situations (CDCA Plan, 1980, as amended).

The Multiple-Use management guidelines for Class L areas such as the HGLA address motorized vehicle access and transportation as follows:

- New roads and ways may be developed under right-of-way grants or pursuant to regulations or approved plans of operation. Motorized vehicle use will be allowed on existing routes of travel until designation of routes is accomplished.
- Vehicle use on some significant dunes and dry lakebeds is allowed.
- Periodic or seasonal closures or limitations of routes of travel may be required.
- Access will be provided for mineral exploration and development.

4.18.1.2 Impact Criteria

The following criteria were used to determine impacts to the transportation network and traffic flows. Potential impacts could occur if an alternative were to:

- Disrupt or improve the existing transportation patterns and systems;
- Worsen or improve the existing level of service (LOS); and
- Change existing levels of traffic safety.

More specifically, physical changes such as construction activities, construction-related traffic on local roads, population and labor force changes, and closing, rerouting, or constructing new roads could disrupt existing conditions. In addition, on roadways that have no history of exceeding their design capacities, an alternative could create significant impacts if it increased traffic to the point that the traffic exceeded design capacities. Such increases could worsen the existing LOS on roadways in and around the HGLA. Furthermore, an alternative could create traffic safety risks if its activities or components conflicted with a community's emergency vehicle routes, or if it featured designs and uses that were incompatible with traffic management policies. Such risks could also impact the transportation network and traffic flows.

The potential risks of impacts are ranked on a high-to-low scale:

High

If there are significant impacts on the above criteria;

Medium

If there are moderate impacts on the above criteria; and

Low

If there are minor or no impacts on the above criteria.

4.18.2 Direct/Indirect Impacts

4.18.2.1 General Impacts

Table 4.18-1 presents the projected number of vehicle trips for each phase of the Reasonably Foreseeable Development (RFD) scenario including exploration, construction, and operation and maintenance activities. During these reasonably foreseeable activities, increased vehicle traffic to the HGLA impacts the existing transportation network and traffic flows to varying degrees. The increase in vehicular traffic would be directly proportional to the number of

vehicles used to transport employees between their residences, the program site(s), and program-related businesses that provide goods and services. Vehicular traffic would include personal as well as commercial vehicles. While it is difficult to quantify future traffic patterns and how many more vehicles, including visitor traffic, would use local and trunk roads, it is possible to base projected traffic estimates on the RFD scenario. For clarity, Table 4.18-1 estimates project-related vehicular traffic for the maximum build-out scenario, including drilling 20 temperature gradient wells and 22 production/injection wells per 30-MW geothermal plant.

It is important to note that while the data in Table 4.18-1 reflects the maximum number of workers likely to be needed during each development phase, the number of personal vehicles is a conservative estimate based on the assumption that employees will carpool. The number of personal vehicles, and thus the number of trips, might double upon realizing the full RFD scenario.

Should BLM open the land for geothermal exploration, development, and utilization, the number of vehicles and vehicle trips would approximate those presented in Table 3.15-3. Using the above data, during construction of the first and second geothermal plants, workers would use 115 and 127 personal vehicles to access the HGLA on a daily basis, respectively. During exploration, environmental permitting, and operational activities, the 54 personal vehicles that workers would use to access the HGLA would not be expected to substantially impede existing traffic flows along US 395 and feeder roads. More specifically, many of these personal vehicles (21) would belong to operations workers, who would be long-term residents of nearby communities and whose vehicles would be part of the area's existing traffic flows.

Construction activities would include 115 and 127 personal vehicles, of which 86 and 95 personal vehicles would be added to the existing traffic flows in and around the HGLA. To estimate these vehicles' impacts on existing traffic flows, it is important to identify which directions the construction traffic would flow during weekday mornings and weekday evenings. Based on the social and economic conditions analyses presented in Section 3.16, 25 percent of the construction workers would be residents of the socioeconomic study area (SSA) and their vehicles would be part of the area's existing traffic flows. The remaining 75 percent, approximately 256 and 281 construction workers, would not be residents of the SSA. Thus, 87 production/injection well workers and 22 makeup well workers would commute from locations outside of the SSA to the HGLA.

Table 4.18-1 Total Projected Traffic Generated During Each Development Phase for Two 30-MW Geothermal Plants

Development Phase	Laborers ¹	Duration	Personal Vehicles (PV) ²		Construction Vehicles (CV)		PV Trips	CV Trips
			Vehicles	Trips/Day ³	Tractor Trailers	Trips/Well ¹		
Exploration	60	2 years	20	2	20 ⁴	30	20,800 ⁵	600
Environmental Permitting	40	18 months	13	2	N/A	N/A	468 ⁶	N/A
Construction								
Geothermal plant								
Production/Injection Wells	116	5 years	40	2	22	30	104,000 ⁷	660
Makeup Wells (1 well every three years)	29/well	5 months	10	2	10	30	20,000 ⁸	300
Operation and Maintenance	62	30 years	21	2	15 ⁹	4 ¹⁰	327,600 ¹¹	60
Total Trips Generated							474,488	

¹ Based on Section 3.16, Social and Economic Conditions.

² The number of personal vehicles (PV) assumes that the workers will carpool, with three workers per vehicle.

³ These values assume workers will make one trip to the site in the morning, remain on-site during the day, and make one trip home in the evening.

⁴ Based on the Truckhaven EIS, one tractor trailer was needed for each exploration well. Thus, 20 tractor trailers would be needed for the HGLA's maximum of 20 exploration wells, i.e., temperature gradient wells.

⁵ This value assumes 40 vehicle-trips per day, five days per week, for 104 weeks.

⁶ This value assumes that BLM and contractor personnel will visit the site for one day during each month.

⁷ This value assumes 80 vehicle-trips per day, five days per week, for three years.

⁸ This value assumes 20 vehicle-trips per day, five days per week, for five months, equaling 2,000 PV trips. Replacing one well every three years for 30 years equals 10 wells, and thus 20,000 PV trips.

⁹ Based on the Truckhaven EIS, this value assumes one major maintenance overhaul every three years, or 10 overhauls during the power plant's lifetime. The overhauls might include using a drill rig or a coiled-tubing unit for cleaning downhole scaling that might build up on the inside wall of a well. Thus, over the 30-year lifetime, this value assumes 10 drill rigs might be used. Additionally, this value assumes that every six years, a crane or boom truck would be used to remove and replace the power plant's pumps. Again, over the 30-year lifetime, pump removal and replacement would include using five cranes or boom trucks. In sum, it is assumed that 15 tractor trailers would be needed to transport the 10 drill rigs and five cranes to and from the power plant site.

¹⁰ This value assumes that the tractor trailer driver would travel to and from the site twice, once to deliver the drill rig and crane, and once to retrieve the drill rig and crane.

¹¹ This value assumes 42 vehicle-trips per day, five days per week, for 30 years.

Of these 256 construction workers for the first plant and 281 construction workers for the second plant, 60 percent, or 154 workers and 169 workers, would find transient accommodations in Kern County. All of these workers would be expected to find accommodations in and around the City of Ridgecrest, which has adequate hotel availability

and lies approximately 40 miles southeast of the HGLA. Thirty percent would be expected to find transient accommodations in Inyo County, which also has adequate hotel availability and RV spaces. The remaining 10 percent would be expected to find transient accommodations in San Bernardino County.

The 154 construction workers staying in and around the City of Ridgecrest would add an estimated 51 personal vehicles to the US 395 corridor between the HGLA and the City of Ridgecrest. During weekday mornings, these construction workers would travel west through the City and north along US 395 to reach the HGLA. During weekday late afternoons, the workers would leave the HGLA, travel south along US 395, and east into and around the City. The 169 construction workers would add an estimated 56 personal vehicles to the US 395 corridor and follow a similar route as for the first plant's construction workers.

The construction workers staying in Inyo County would add an estimated fewer personal vehicles to the existing traffic flows along US 395. During weekday mornings, these construction workers would travel south along US 395 to reach the HGLA. During weekday late afternoons, the workers would leave the HGLA and travel north along US 395 to reach their accommodations in Olancho and Lone Pine.

The workers commuting from San Bernardino County would add fewer personal vehicles to the SR 178 and US 395 corridors than would the workers staying in Inyo County. During weekday mornings, these construction workers would leave San Bernardino County and travel west along SR 178 to the City of Ridgecrest. As these workers enter the City, their travel routes would follow those of the 154 and 169 workers above. During weekday late afternoons, the workers' trips from the HGLA would follow those of the Ridgecrest-bound workers.

With regard to the impact on existing traffic flows, exploration, environmental permitting, and construction activities would add 148 personal vehicles to the US 395 corridor in the vicinity of the HGLA for the first plant's construction and 160 personal vehicles for the second plant's construction. More specifically, the first plant's 341 total construction workers would use 115 personal vehicles; the second plant's 375 total construction workers would use 127 personal vehicles. Exploration workers would use an additional 20 personal vehicles, which would represent a negligible increase relative to the existing traffic volumes along US 395 and feeder roads. The project's increase in personal vehicles in the Ridgecrest and San Bernardino County areas would represent a negligible increase relative to the 2007 traffic volume along SR 178. SR 178 extends in an east-west direction on the City of Ridgecrest's east side. Though the existing LOS is unknown at intersections along Ridgecrest Boulevard, which extends in an east-west direction between Jack's Ranch Road and the Kern County line, the project would not be expected to substantially disrupt traffic flows or worsen the

existing LOS. In addition, the project's personal vehicles would represent a negligible increase relative to the existing traffic volume along US 395 at the Inyo County-Kern County line. The existing LOS at this county line is LOS D. A negligible increase in the traffic volume would not be expected to worsen existing conditions to LOS E or LOS F.

Adding the project's personal vehicles north of the HGLA would represent a negligible increase in US 395's existing traffic volumes at the Olancho and Lone Pine intersections. The existing LOS at the Olancho intersection is LOS D, with the Lone Pine intersection operating at LOS B. While Inyo County's 2009 Regional Transportation Plan projects increases in traffic volumes at these intersections, it shows no change between the existing LOS and the future LOS at these intersections. Similarly, increasing traffic volumes by a negligible amount would not be expected to substantially change the existing LOS at these intersections.

Should the project's personal vehicles travel off of US 395, and along SR 190 and/or SR 136, they would increase existing traffic volumes by a negligible amount at the SR 190-SR 136 intersection, and along SR 136 approaching US 395. The existing LOS for both locations is LOS A. Inyo County's 2009 Regional Transportation Plan shows no change between the existing LOS and the future LOS in these two locations. The negligible increase in traffic is not expected to disrupt existing LOS A conditions at these two locations.

In addition to the personal vehicles above, BLM officials and consultant staff would use 13 personal vehicles. It is assumed that BLM officials would be long-term residents of the three-county SSA and that their personal vehicles would already be part of the area's existing traffic flows. Additionally, it is assumed that consultant staff would rent personal vehicles from locations near the HGLA. In this way, these rental vehicles would also already be part of the area's existing traffic flows.

In sum, even at the simultaneous build-out of the two 30-MW geothermal plants, the resultant traffic increases would be negligible relative to the existing traffic flows at the locations discussed above. The existing transportation network and traffic flows would accommodate program-related personal vehicle traffic with only negligible to minor impacts on existing LOS conditions.

While the number of personal vehicles would not be expected to substantially disrupt traffic operations in and around the HGLA, the program-related increase in vehicle trips gives cause for safety concerns. More specifically, each day, most of the program's labor force, if not all of it, would travel along US 395 to access the HGLA. Since 2005, most of the injuries and fatalities on Inyo County roadways have occurred on US 395 (Inyo County 2009). Given the duration of the exploration and construction activities, and because most of the construction

workers would commute from outside of the SSA, workers would be expected to gain familiarity with US 395's features and traffic patterns, and adjust their driving behaviors accordingly. Based on existing traffic volumes, safety concerns could escalate with implementation of the Proposed Action if appropriate mitigation and management measures are not taken.

With regard to construction vehicle traffic, because exploration and construction activities would occur during different years, program-related tractor trailer traffic is not an additive function. As such, the program would use 20 tractor trailers during exploration; 32 tractor trailers during construction, which includes makeup/replacement well activities; and 15 tractor trailers during operation and maintenance activities.

To gauge maximum traffic impacts, routing 32 tractor trailers between the HGLA and southern origins and destinations, particularly in and around the City of Ridgecrest, would be expected to have a moderate adverse impact on city and county roadways. Existing truck traffic accounts for 26 percent of the vehicle miles traveled in Kern County. The California average for truck traffic vehicle miles is 10 percent (Kern County 2007). Additionally, traffic congestion exists along SR 178 through the City of Ridgecrest and Inyokern. In these communities, SR 178 is routed along streets that are primarily used for local trips. Routing truck traffic through these communities could cause delays at intersections. However, the delays would not be expected to reduce LOS conditions below LOS D, which the County seeks to maintain as a minimum LOS.

Additionally, safety risks could arise from US 395's four-lane facility traversing the HGLA, particularly considering the number of tractor trailers that opening the land for leasing would add to this roadway segment. The number of light or medium trucks would add a minimal amount of vehicle trips relative to tractor trailer trips. However, light or medium trucks might also contribute to safety risks along US 395's four-lane facility.

4.18.2.2 Impacts by Alternative

Alternative A – Open the Entire HGLA for Geothermal Exploration, Development and Leasing; Amend the CDCA Plan to have the HGLA Open and Available for Geothermal Exploration, Development and Leasing; Authorize All Pending Leases Within the HGLA

Under Alternative A the CDCA Plan would be amended to reflect the delineated HGLA as open to geothermal leasing for direct and indirect use, and 22,805 acres of BLM-administered lands or federal mineral estate would be made available for geothermal exploration, development, and utilization. Groundwater extraction for consumptive use

during exploration, development, and production would be allowed, but controlled or restricted by stipulation. Limited groundwater use may be allowed under certain conditions specified in Chapter 2 and in SA-HGLA-10. Under this alternative the BLM would authorize the three pending non-competitive lease applications for 4,277 acres.

Impacts to traffic volumes and the transportation network surrounding and accessing the HGLA under Alternative A would be considered low. More specifically, the project's personal vehicle traffic would be expected to represent a negligible increase in the region's traffic flow. LOS conditions would be expected to approximate existing conditions in and around the HGLA. This assessment is based on the projected levels of adverse impacts to the existing transportation patterns and systems, to the existing levels of service on public roads and highways, and to highway safety.

Alternative B – Close the Entire HGLA to Geothermal Exploration, Development and Leasing; Amend the CDCA Plan to have the HGLA Closed and Unavailable for Geothermal Exploration, Development and Leasing; Deny Authorization of All Pending Leases Within the HGLA

Under Alternative B, BLM-administered lands located within the HGLA would be closed to geothermal leasing, and the CDCA Plan would be amended to reflect that decision. Under this alternative the BLM would not offer competitive geothermal leases on any of the 22,805 acres of BLM-administered lands or federal mineral estate within the HGLA, and would deny the three pending non-competitive lease applications.

Alternative B would not result in any impacts on the existing and future transportation network and traffic flows along US 395, SR 136, SR 178, and SR 190 because no geothermal development would occur within the HGLA.

Alternative C – Open the HGLA to Geothermal Exploration, Development and Leasing; with No Surface Occupancy (NSO) Allowed in Sensitive Areas; Amend the CDCA Plan to have the HGLA Open and Available for Geothermal Leasing; Authorize All Pending Leases within the HGLA

Under Alternative C, the CDCA Plan would be amended to reflect the delineated HGLA as open to geothermal leasing for direct and indirect use, but with specific acreages of the HGLA under restrictions of the No Surface Occupancy (NSO) stipulation NSO-HGLA-1. In addition, based on public concerns regarding the use and limited availability of groundwater, groundwater extraction for consumptive use would be prohibited. Under this alternative, the BLM would also authorize the three pending non-competitive lease applications for 4,277

acres, and offer competitive leases for the approximately 18,000 acre balance of BLM-administered lands.

The foreseeable and potential impacts under Alternative C would be expected to be similar as those described for Alternative A since the RFD remains the same under both alternatives, and the impacts, if any, occur outside the boundaries of the HGLA.

Alternative D – Selective Closure of Sensitive Resource Areas within the HGLA for Geothermal Exploration and Development; Amend the CDCA Plan to have Designated Areas within the HGLA Open and Available for Geothermal Leasing; Amend the CDCA Plan to have Designated Areas within the HGLA Closed and Unavailable for Geothermal Leasing; Authorize All Pending Leases Within the HGLA

Under Alternative D, the BLM would close specific areas within the HGLA to geothermal leasing to protect sensitive resources while opening the remainder of the HGLA to leasing. Of the 22,805 acres of BLM managed lands or federal mineral estate within the HGLA, 13,773 acres would be closed and the remaining acres would be open in this alternative. In addition, based on public concerns regarding the use and limited availability of groundwater, groundwater extraction for consumptive use would be prohibited. The CDCA Plan would be amended to reflect the specific areas that are open and closed to geothermal exploration, development, and utilization. Under Alternative D, the BLM would also authorize the three modified pending non-competitive lease applications for 4,277 acres.

The foreseeable and potential impacts under Alternative D would be expected to be similar to those expected under Alternatives A and C since the RFD remains the same under all alternatives, and the impacts, if any, occur outside the boundaries of the HGLA.

Alternative E – No Action

Under the No Action Alternative, the CDCA Plan would not be amended, and the existing plan decisions, stipulations, and allocations would not change as a direct result of this EIS process. The HGLA would remain under management of the current CDCA Plan, which does not identify the HGLA as open or closed to geothermal leasing, nor does it indicate the availability status of lands within the HGLA. The three pending lease applications would be denied.

Alternative E would not result in any impacts to the transportation network and traffic flows because no geothermal development would occur within the HGLA under present CDCA Plan policies and guidelines.

4.19 SOCIOECONOMICS

4.19.1 Methodology

4.19.1.1 Management Goals

The CDCA Plan currently has no applicable management goals for social or economic conditions, or environmental justice issues. As such, the various federal policies discussed in Chapter 1 provide the direction for assessing impacts. On the county level, the Economic Development Element for the Inyo County General Plan (2001) addresses primarily tourism and redevelopment. However, one of the County General Plan goals and related policy is relevant to the Haiwee program:

“Goal ED-4: Actively encourage the expansion of existing industry of all types (including resource industries, manufacturing and service industries), and actively recruit new businesses that will bring new jobs to the County; **Policy ED-4.1:** Mining Industry: Support the continued operation of existing mining activities within the County as well as new mining in appropriate areas, subject to each operator meeting all applicable safety and environmental laws, regulations, and County policies.”

With regard to environmental justice, Executive Order 12898 “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations” (CEQ 1997) focuses federal attention on the environmental and human conditions of minority populations, and calls on agencies to develop strategies to achieve environmental justice as part of this mission. The USEPA subsequently developed guidelines to assist all federal agencies to develop strategies to address the issue (USEPA 1996). Federal agencies are required to address disproportionately high and adverse human health and environmental effects in their programs, policies, and activities on low-income or minority populations. Since the proposed action is a federal action, it is subject to environmental justice analysis.

4.19.1.2 Impact Criteria

The potential risks of direct and indirect impacts affecting socioeconomic and environmental justice issues are assessed with respect to nine criteria. Potential impacts to socioeconomic and environmental justice issues could occur if the Haiwee RFD actions were to:

- Affect expenditures or incomes within the socioeconomic study area (SSA) associated with the program;
- Induce growth or population concentrations;

- Displace a portion of residences in a community;
- Create a demand for additional housing that could not be sustained within the SSA;
- Cause a decrease in SSA or regional employment;
- Displace or disrupt businesses in the SSA;
- Generate student enrollment that exceeds the school district's capability to accommodate them;
- Cause a disproportionately high and adverse impact on minority or low-income populations; or
- Create perceptions of threats or opportunities affecting lifestyles, beliefs, and values about the quality of life in adjacent communities.

The potential risk of impacts affecting socioeconomic resources and environmental justice issues from exploration, geothermal development, electric power production, or reclamation uses a high-to-low scale. The following definitions of high, medium, and low are used in assessing these potential risks:

High

If there are significant impacts on the above criteria.

Medium

If there are moderate impacts on the above criteria.

Low

If there are minor or no impacts on the above criteria.

4.19.2 Direct/Indirect Impacts**4.19.2.1 General Impacts**

Local socioeconomic impacts from implementation of the Haiwee RFD would arise primarily from the preliminary feasibility studies, exploration activities, construction, and subsequent operation of the two geothermal plants. These activities would create in the short term new jobs and produce new local expenditures that would, in turn, generate secondary economic impacts in the form of additional jobs and income ("ripple effects"), increased public revenue, and an increase in the local population. This population growth could then

impact community infrastructure such as housing, schools, domestic water systems, etc., as well as social well-being. However, in the context of the broader regional, state, and national energy economy goals and policies, the development of the HGLA would yield benefits such as low-emission electric power while avoiding many of the typical external social costs associated with fossil fuel plants.

Socioeconomic impacts would be felt throughout the broader region of Inyo, Kern, and San Bernardino Counties. However, these impacts would be focused on conditions in the Haiwee SSA. Some exploration and construction workers would most likely come from outside the three-county area because many skills needed for implementation of the Haiwee RFD are specific to the geothermal sector. If hired from outside the SSA, temporary workers are likely to relocate into the SSA during the exploration and construction phase to minimize their commutes. Jobs related to permanent operations and maintenance in the long term would be expected to remain in the SSA, either because workers were residents at the time of their hire, or subsequently moved into the SSA.

Because future Haiwee geothermal facilities would be located in Inyo County, most of the public revenue benefits, in the form of property taxes and royalty revenues, would be received by jurisdictions within Inyo County. The County would also be the recipient of 25 percent of the resulting federal royalties. Increased sales tax revenues would accrue to the jurisdictions where workers reside and obtain retail goods and services; both short-term and long-term workers are expected to reside in each of the three counties.

Potential social impacts associated with the geothermal facilities are most likely to result from local perceptions about threats and opportunities that may affect lifestyles and perceptions of community quality of life (Freudenburg, et al. 1994; Leistritz, et al. 1981). Such perceptions often stem from the assessment of facility characteristics and their potential for risk or benefit to families and individuals in adjacent communities (Slovic, et al. 1991; Edelstein 2004). However, since geothermal facilities already exist within the region, particularly at Coso, local residents are familiar with geothermal power generation.

As voiced during public scoping meetings, water resources are of key interest to local residents. The concern regarding impacts of the proposed action has been so common as to view water as a widespread community concern. With regard to potential social disruption resulting from the in-migration of individuals who do not share community values, the level of long-term in-migration is expected to be insignificant. Moreover, there is no reason to assume that these individuals would have different values and attitudes from those in the existing community. In fact, they may be attracted to these communities based on their perception of compatible community values. However, the temporary in-migrating construction workers, who could number about 226 individuals during the peak of

construction, could represent a noticeable, but temporary change in the community population. Based on the projected impacts under the Haiwee RFD scenario, the additional facilities would be unlikely to result in perceptions of threat to health or quality of life, changes in activity patterns, or substantial changes in the values and beliefs about the quality of place in Haiwee social environment. It is more likely that residents in adjacent communities will find the RFD acceptable because it will offer employment, generate taxes, and be consistent with other existing geothermal facilities nearby.

Employment and Wages

A combination of expert opinion and public studies was used to estimate employment and wages that could be generated as a result of implementation of the Haiwee RFD scenario. A workforce schedule was produced entailing the preliminary field studies, seismic testing, development of temperature gradient wells, environmental permitting, plant construction, development of production and injection wells, and facility operation.

Seismic Testing and Temperature Gradient Wells

Employment levels for the initial phases of seismic testing, and for drilling and testing of the exploratory temperature gradient wells, were estimated based on representative levels typical for access road construction and well development. These phases were assumed to last about two years total. Figure 4.20-1 shows that, during this two-year phase, an average of about 40 jobs would be created, with potential peaks of up to about 60 workers. The actual timing of these phases, and the corresponding employment levels from month to month, could vary from this preliminary assessment as local conditions merit, and testing regimes change in response to new information produced by that testing. However, the overall employment averages and peaks are considered reasonable best estimates. The start date of January 2013 serves as a representative date, and actual dates of commencement could be later, in which case the schedule shown in Figure 4.20-1 would be delayed accordingly.

Environmental permitting

Environmental permitting will occur if the testing phase reveals that proceeding to plant development could be feasible. The Haiwee RFD assumes it will be feasible; if it is not, then no further action would occur. Environmental permitting would include preparation of project- and site-specific EISs and EIRs as well as numerous permit studies and applications. The manpower schedule estimates a total of 18 months to obtain the permits required to allow construction of the geothermal plants and drilling of the production and injection wells. An average of 40 employees, including consultants and BLM personnel, would be typical for this phase. The BLM personnel would be located in the three-county SSA. Consultants would likely be based in offices outside the SSA but performing periodic site visits; local hiring for this phase would be minimal.

Construction of geothermal plants and production/injection wells

Published materials, such as Hance (2006), relied on analysis of geothermal projects that are not directly comparable to the conditions and assumptions in the Haiwee RFD. These sources were evaluated and considered, but ultimately primarily expert opinion was used to project the impacts for this peak activity period.

Drilling of the production and injection wells would occur 24 hours per day, seven days per week, and in two 12-hour shifts with a staff of about 13 persons during the day shift, and five on the night shift, each working five shifts per week for five months. Incorporating allowances for holidays, vacations, and sick time, the average number of employees needed to drill one well and place it in operation would be about 29 workers. Based on the RFD assumptions, and four wells being drilled at a time, an estimated 116 employees would be required over a period of about five years. However, due to shift work, the actual number of employees on-site at any one time would be less than 116.

Operation and maintenance

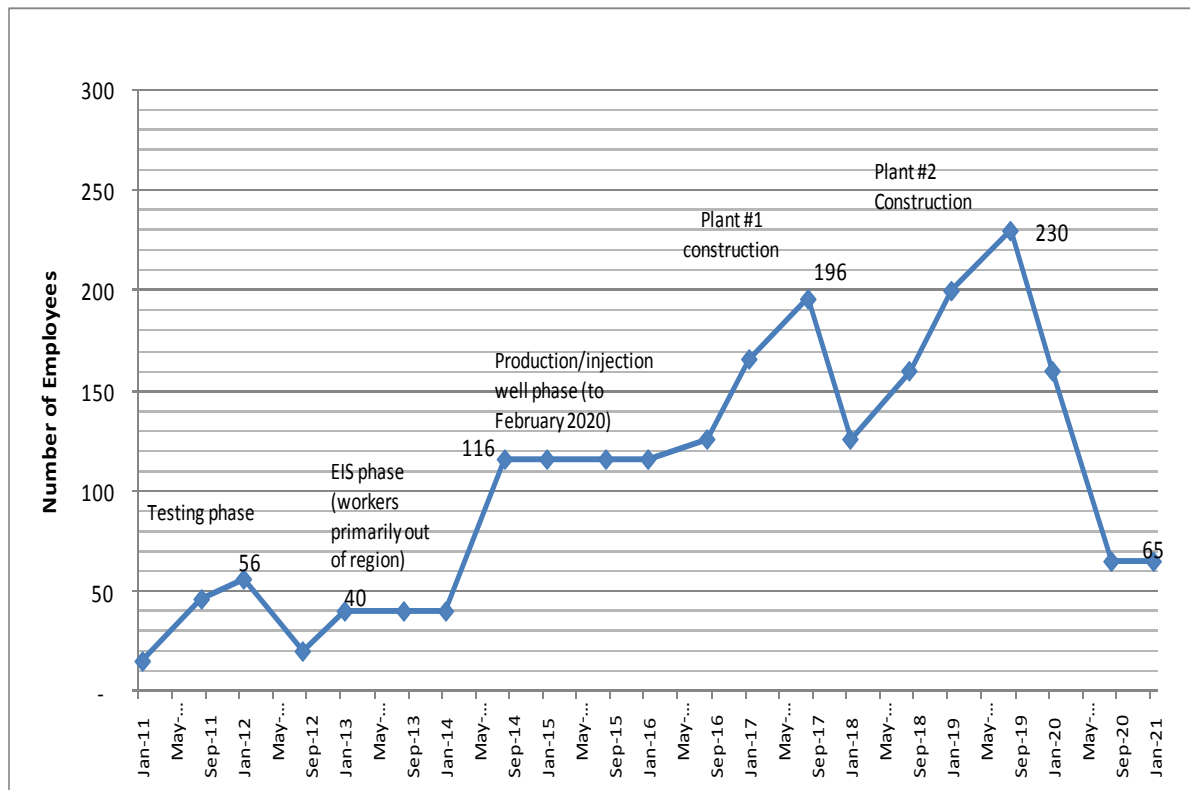
Operations and maintenance of two 30 MW geothermal plants is estimated to require a work force of six workers apiece, for each two eight hour shifts, with a skeleton staff of four workers for a third shift. Thus, employment for geothermal plant and well operation and maintenance is estimated at about 62 workers for both plants.

Additional makeup production and injection wells are projected to be needed to replace worn-out wells and upgrade configuration. Based on the RFD projections, these wells are expected to be needed at a rate of one new well during every three years of operation. This would require a work force of about 29 workers for five months every three years, on average.

Personnel costs

Costs of staffing the Haiwee RFD facilities are important personnel costs and are a major part of the total cost of the program, because wage and salary payments would be a main stimulus to the local economy. In contrast, local purchases of equipment and services to conduct exploration, development, and operation and maintenance are expected to be relatively minor compared to total program purchases, because the specialized equipment needed for these activities is expected to be purchased from outside the SSA and the larger three-county area, thereby not increasing local sales or creating any local economic ripple effects.

Figure 4.19-1 Reasonable Foreseeable Development, Projected Employment Schedule



Source: POWER Engineers and Economic Planning Resources 2010.

The estimates of wages and salaries used herein are based largely upon the current “prevailing wages” for construction in California. These are published by the Office of the California Director of Industrial Relations (2009) for construction trades, which are used herein for plant and road construction. Union wage rates for journeyman well drillers (Southern California District Council of Laborers 2006) were used for both temperature gradient and production and injection well development, increased somewhat due to the need for well engineers on-site. Environmental permitting rates were used based on knowledge of average salaries for consultants and BLM personnel. In all cases, the assumptions were that crew averages would approximate journeyman wages. The assumed average wage rates and resulting monthly costs by type of worker are shown in Table 4.19-1.

Using the assumptions in Figure 4.19-1 and Table 4.19-1 the total cost of wages/salaries/benefits, from initiation of geothermal development through the first year of operation of both plants, was estimated at \$124 million. Annual operation and maintenance labor costs were estimated at \$7.5 million.

Table 4.19-1 Assumptions for Labor Costs, Proposed Action, Monthly Basis

	Base/hr	Hrs/wk	% non-specialized skill, SSA available	Monthly water incl. overtime at 150%, 200%, Sun./holidays	Total including 50% overheads to contractors, plus 50% union, 25% non-union benefits	Monetizable benefits at \$5/hr union, \$3 non- union	Plus benefits at 50% union, 25% non-union
Surveyors	\$ 28	50	50%	\$ 3,046	\$ 6,854	\$ 3,296	\$4,570
Water well driller, seismic tester only	\$ 30	50	25%	\$ 3,246	\$ 7,344	\$ 3,514	\$4,896
Water well drillers, including engineer	\$ 35	60	20%	\$ 6,216	\$ 13,986	\$ 6,516	\$9,324
Well tester	\$ 35	50	25%	\$ 3,808	\$ 8,568	\$ 4,058	\$ 5,712
Engineer	\$ 50	50	10%	\$ 5,440	\$ 10,200	\$ 5,590	\$ 6,800
Geothermal plant operations	\$ 34	40	50%	\$ 6,433	\$ 14,474	\$ 6,633	\$ 9,649
Geothermal plant construction	\$ 33	60	30%	\$ 5,861	\$ 13,187	\$ 6,161	\$ 8,791
Environmental Planner	\$ 45	40	25%	\$ 7,740	\$ 14,513	\$ 7,860	\$ 9,675

Source: POWER Engineers and Economic Planning Resources 2010.

Local versus non-local workers

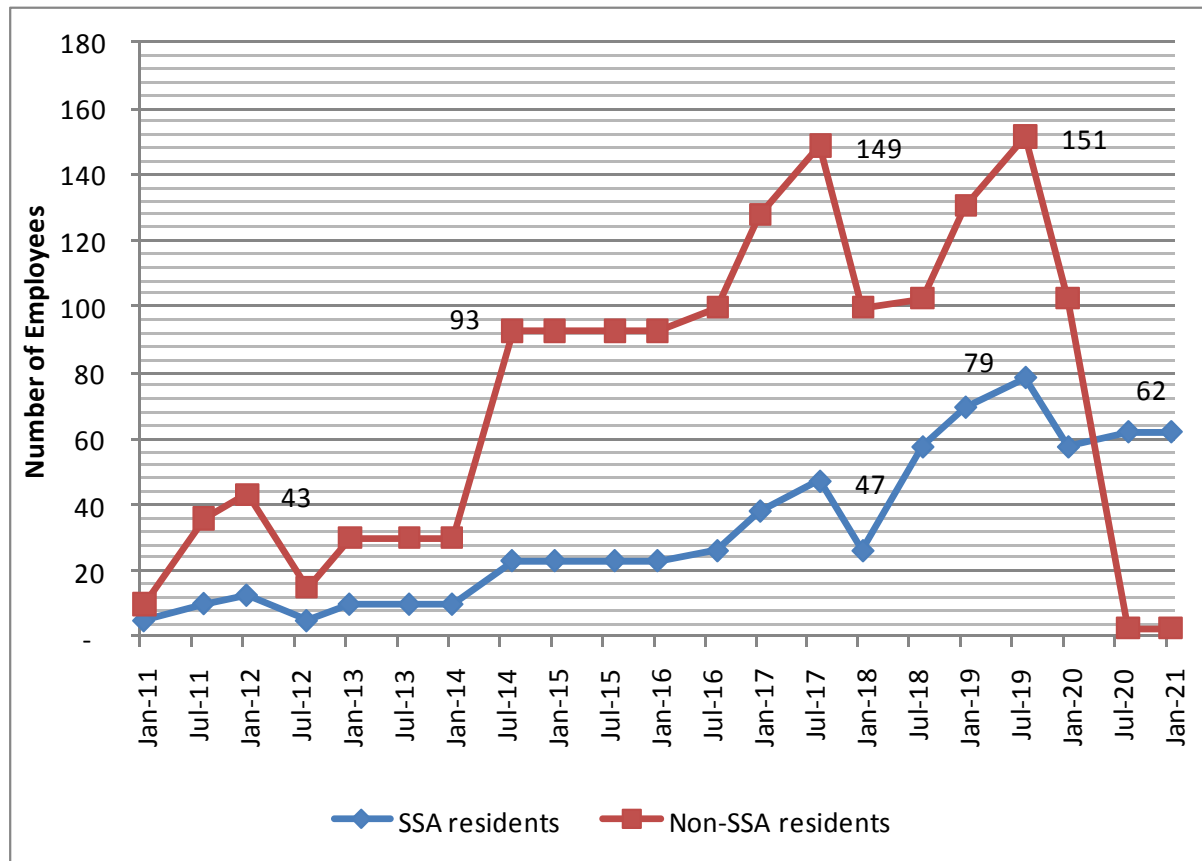
The RFD workforce requirements shown in Figure 4.19-1 describe project phases which require an extensive set of specialized skills. Some skills are in short supply in the locally-available SSA work force. Thus, only a limited number of local hires would likely come from the SSA. Estimates of local versus non-local hires, shown in Figure 4.19-2, were based on the proportions of potentially available local workers (Table 4.19-1) and the workforce schedule shown in Figure 4.19-1. These estimates indicate that, at the peak of construction, about 150 workers would be hired from outside the SSA. In regard to housing impacts, these workers are expected to relocate temporarily to the SSA, living in transient housing (hotels or RV parks) but leaving for other work opportunities when their jobs are completed. At the peak, about 80 workers are projected to be residents of the SSA at the time of their hire.

Total costs

The RFD scenario does not include any estimate of expenditures for plant construction or operation. However, information in Hance (2005) includes alternative methods for estimating total costs, including a range of \$3,100-3,500 per kW (2005 dollars), and an average labor to total cost ratio of 41%. These costs, using “burdened” labor costs (wages, salaries, benefits, and contractor overheads assumed at 30%) indicate a total cost estimate through construction

of about \$204-327 million (2010 dollars). Using the average of these two estimates, results in a total estimate of costs through construction of \$265 million.

Figure 4.19-2 Local versus Non-Local Work Forces



Source: POWER Engineers and Economic Planning Resources 2010.

Operation costs have also been estimated in Hance (2005) as comprised of 42-74% labor costs. Using total burdened labor costs (wages, salaries, benefits, and 30% for overheads), and a midrange of 58% of total operations and maintenance costs accounted for by labor, the annual operating costs would be about \$17 million (2009 dollars).

Annual and cumulative construction costs were derived by allocating all costs according to the workforce schedule shown in Figure 4.20-1. The resulting year-by-year cost estimates are shown in Table 4.20-2. Since the first geothermal plant is assumed to be in operation during the construction of the second geothermal plant, the actual costs for construction and operation the first plant would be somewhat higher than shown.

Table 4.19-2 Estimated Development Costs by Year

	Annual Construction Cost (\$millions 2010)	Cumulative Construction Cost
2011	\$10,595,361	\$10,595,361
2012	\$6,426,470	\$17,021,832
2013	\$11,270,422	\$28,292,254
2014	\$19,689,724	\$47,981,978
2015	\$31,476,747	\$79,458,725
2016	\$33,610,264	\$113,068,989
2017	\$48,694,230	\$161,763,219
2018	\$34,796,962	\$196,560,181
2019	\$48,753,542	\$245,313,723
2020	\$20,208,760	\$265,522,483
2021 (operational)	\$16,807,468	
Total Construction cost	\$265,522,483	

Source: POWER Engineers and Economic Planning Resources 2010.

Impacts on Employment and Income

This socioeconomic assessment used the input-output economic model *Impact Analysis for Planning* (IMPLAN, trademark IMG, Inc.) to estimate secondary employment impacts of the program. The model produces multipliers that allowed calculation of the secondary (or “ripple”) impacts of the program arising from the re-spending of payments to labor and direct suppliers during the individual exploration, permitting, construction, and operation phases.

In order to estimate ripple impacts, the injection of income into the Kern-Inyo County region from the RFD scenario was estimated. This estimate included labor costs of wages/salaries/benefits, and direct purchases of goods and services needed for development (including but not limited to aggregate, equipment rental and leasing, security, etc.). Included in the direct purchases are increased local expenditures for hotel/RV facilities, restaurants, groceries, etc. by the temporarily in-migrating exploration and construction workers.

IMPLAN is only estimated on a county-wide basis because most of the necessary data for the model are available only county-wide. For this assessment, the primary geographic used was Kern and Inyo Counties, combined. Very little impact is likely to occur in Inyo County, even though the proposed HGLA lies in the county. Inyo County is much smaller (10,742 jobs in 2008 versus 372,421 in Kern County), has a much less diversified economy, and is less able to serve local demand in comparison with the Mojave Desert portion of Kern County. Much of the local demand for goods and services, as well as the source of most permanent workers, would be the Ridgecrest area in Kern County rather than in Inyo County.

San Bernardino County was not explicitly included in the IMPLAN analysis since (1) very few workers or purchases of goods and services are expected from San Bernardino County, (2) all but a small fraction of its economic activity is distant from the Haiwee SSA, and (3) local-markets serving economic activity in the San Bernardino County portion of the SSA, located in the Trona/Red Mountain/Searles Valley, is very limited. The secondary effect estimates developed for Inyo and Kern Counties can be applied to the entire three-county area as well as the Haiwee SSA, with little error.

The results of the analysis focus on employment impacts because the employment opportunities provided by both on-site activity and its ripple effects would also cause increases in transient and permanent populations. However, benefits to personal incomes are also notable as further indicators of potential benefits of the Proposed Action.

Because development of the Haiwee RFD facilities would, in general, require relatively specialized labor and materials not in plentiful supply in Kern and Inyo Counties, and because their economies, particularly that of Inyo County, are relatively small and rely heavily on imported goods and services, the results show very small ripple effects of BLM's proposed action on employment or labor income. These results are shown in Table 4.20-3, and indicate employment "multipliers" generally in the range of 1.15 to 1.22 for the Kern-Inyo County area as a whole. Even smaller multipliers would likely apply if only the SSA were considered since the SSA is even less able to capture the impacts of worker and program purchase spending than the broader Inyo-Kern County area.¹²

However, a high-side bias in secondary employment projections for the SSA is useful for a worst-case impact assessment because it shows slightly high-side population and housing impacts, which help substantiate the conclusion of low socioeconomic impact.

Impacts on Population and Housing

Impacts on population and housing will differ markedly during the subsequent operation phase from, the prior years of exploration, permitting, and construction.

During operation, all permanent employees at the geothermal plants and ancillary facilities are expected to be either SSA residents at the time of their hire, or to move into the SSA to work. In contrast to the temporary construction workforce, operations workers moving to the area (assumed to be half the work force, or about 30 workers) are assumed to bring families and household members with them. The same would be true for workers who may in-migrate to take service-sector, or secondary, jobs supported as a result of the program, estimated to total about 15 workers (Table 4.20-2). Thus, operations-phase increases in housing demand will be for year-round rental or ownership housing; only limited demand for transient

¹² In more urbanized economies for less specialized projects, multipliers can range upwards of 2.0 to 3.0.

accommodations would occur, largely due to business visitors. Since local supplies of rental and for-sale housing are ample for this level of in-migration, no adverse impacts to the local housing market should be evident. By comparison, temporary workers would be expected to seek primarily transient housing such as hotels or RV parks, with only limited reliance on rental accommodations, except perhaps during the summer peak demand for transient housing. As shown in Figure 4.20-2, at the peak of construction about 151 construction workers would be working on the Haiwee program and living in the SSA, compared to a maximum of only 43 workers during the permitting and exploration phases.

Table 4.19-3 Selected Results of IMPLAN model for Kern and Inyo Counties (combined)

Peak year (2019)		
Impact Type		Employment
	On Site	217
	Direct Effect from Purchases	121
Total On Site and Direct from Purchases		338
Ripple Effects		
	Indirect Effects	14
	Induced Effect	38
Total Ripple Effect		52
Total Effect		390
Implied Multiplier		1.15

Operating (2021+)		
Impact Type		Employment
	On Site	65
	Direct Effect from Purchases	11
Total On Site and Direct from Purchases		76
Ripple Effects		
	Indirect Effects	1
	Induced Effect	14
Total Ripple Effect		15
Total Effect		91
Implied Multiplier		1.20

Total All Years	
Impact Type	Employment
On Site	1,184
Direct Effect from Purchases	665
Total On Site and Direct from Purchases	1,849
Ripple Effects	
Indirect Effects	78
Induced Effect	326
Total Ripple Effect	404
Total Effect	2253
Implied Multiplier	1.22

Inyo County currently has an off-season availability of about 65-80 hotel rooms and about 100 RV spaces. In contrast, there is very little availability of hotel rooms and RV parking during the April-October peak visitor period. Under present conditions available hotel and RV spaces in Inyo County are likely to be scarce during peak months. This effect is judged as insignificant, however, because hotel availability in Ridgecrest is very adequate (currently totaling 1,100 rooms with about 35% vacancy in the off-season from November to March), with only rare and brief times when occupancy nears 100 percent during the April-October peak visitor season.

This housing and population impact assessment provides a range of potential outcomes based on two different assumptions about the proportion of production/injection well workers who will choose to relocate permanently into the SSA. The first assumption is that all of these workers would choose to remain in transient housing. An alternative assumption is that 80% would ultimately choose to relocate permanently, bringing dependents and renting or owning homes.

The primary constraint upon transient accommodation availability would occur during construction, when an average of about 120 construction workers (ranging from a minimum of 90 transient workers to a maximum of 150 workers at the peak of construction) will require hotel rooms or RV spaces. This level of demand could result in some excess demand if the demand would occur entirely in Inyo County, particularly during the April-October peak season. However, the presence of ample room availability in the Ridgecrest area, and even a small availability in the San Bernardino portion of the SSA, would ensure that all workers can find accommodations in or near the SSA. Based on the current distribution of available accommodations, about 45 workers are predicted to reside in Inyo County, 90 in

Kern County, and 15 in San Bernardino County transient accommodations at the peak of construction.¹³

During the years before operation, the primary geothermal development related housing demands will be for transient housing. However, the ripple effects from the economic stimulus provided by the RFD scenario would result in a variety of additional service-sector jobs, as described previously under “Employment and Income.” While most of those jobs would be filled by local residents, the overall increase in labor demand would induce some in-migration of service-sector workers who may intend to remain in the area. Their numbers are estimated at 52 secondary jobs during the peak construction years (Table 4.20-2). This influx would also look for more permanent rental or ownership housing, for which adequate supplies exist in the SSA.

In sum, the impact on housing and population from BLM’s Proposed Action is likely to be very minimal during the years before construction begins, less than moderate during the peak of construction, and again minimal during operations because operations housing demand will be for rental or ownership housing, supplies of which are ample in the SSA. Table 4.20-4 summarizes the results for the projected population and housing impacts.

Including temporary workers, the total population increase to the SSA in the peak year of construction is estimated at 283 persons, or 0.4% of the estimated 2009 population of the SSA. This increase would not last past the peak construction months. The operations phase would increase the SSA population by only 124 persons, all but an estimated three workers for periodic makeup well work, would be long-term residents.

Table 4.20-4 also shows the projections for the scenario of 80% of the in-migrating construction workers choosing to look for permanent housing. In this case, the number of workers seeking transient accommodations in the peak year would decline from about 150 to about 60 workers and impacts on hotel/RV availability would be negligible. Again, based on availability, the resulting impacts of this scenario on population and housing would remain low, representing only about a 0.6% increase to the SSA population.

¹³ This peak in transient housing demand would be further reduced if more than the 20% of production/injection well drillers assumed to be local residents were increased. Since this component of the RFD is slated to last for about five years, many of the 93 in-migrating well-drilling workers (80% of the total workforce of 116, or 93 workers) would be likely to become long-term residents, establishing households and choosing rental or ownership housing, rather than transient accommodations.

Table 4.19-4 Population and Housing Impacts Summary, Proposed Action

Percent of Production/Injection Well Drillers Becoming Long-Term Residents				
	20 Percent		80 Percent	
	Peak Year (2019)	Annual Operation (2021+)	Peak Year (2019)	Annual Operation (2021+)
Population				
Temporary in-migrants (peak month) – no dependents	151	0	58	0
Jobs filled by long-term in-migrants				
Site jobs filled by long-term in-migrants	0	34	93	34
Number of secondary jobs (ripple effects), held by long-term in-migrants	52	15	52	15
Total jobs held by long-term in-migrants	52	49	145	49
Average household size	2.53	2.53	2.53	2.53
Total long-term in-migrants population	132	124	425	124
Plus temporary in-migrants (total permanent plus temporary population increase)	283	124	425	124
Likely split by area ¹				
South Inyo County	127	37	191	37
Northeast Kern County	127	75	191	75
Trona/Red Mountain/Searles Valley, San Bernardino County	28	12	42	12

Percent of Production/Injection Well Drillers Becoming Long-Term Residents				
	20 Percent		80 Percent	
	Peak Year (2019)	Annual Operation (2021+)	Peak Year (2019)	Annual Operation (2021+)
Housing				
Number of households				
Temporary (nearly all hotels and RV parks)	151	0	58	0
Likely split by area ¹				
South Inyo County	45	0	58	0
Northeast Kern County	91	0	17	0
Trona/Red Mountain/Searles Valley, San Bernardino County	15	0	35	0
Permanent (rental and ownership housing)	52	49	6	0
Likely split by area ¹				
South Inyo County	16	15	43	15
Northeast Kern County	31	29	87	29
Trona/Red Mountain/Searles Valley, San Bernardino County	5	5	14	5

¹Assumed split: 30% to Inyo County, 60% to Kern County, and 10% to San Bernardino County.

Impacts to Public Services

The degree of potential adverse impacts to public services typically corresponds primarily to the level of population increase in their jurisdictions, and secondarily on employment and income increases, and the associated infrastructure demands compared to existing capacities or difficulty of expansion of services. Where “choke points” such as lack of excess capacity of schools, water systems, police and fire protection exist, significant adverse impacts can occur depending on the magnitude of increased demands.

Given the very low population impacts described for the HGLA, correspondingly low impacts on public services can be expected. As described in Chapter 3, Public Services, the SSA’s public service providers generally do not exhibit shortages in excess capacity or ability to readily expand to service new demands. The only reported potential problems are for fire protection and sewage collection in the Ridgecrest area. Neither appears to be a serious constraint for geothermal development in the HGLA. Some funding problems for fire protection in the Ridgecrest area have resulted in minor staffing cuts. The Ridgecrest sewage treatment plant is approaching its rated capacity, but the City has published bids to begin new design for expansion in a timely manner. The lack of evident public service choke points, and the very low increases expected, results in a finding of no significant impact.

Impacts to Public Revenues

This finding of no significant impact on public services is somewhat mitigated by the general status of public finances for California State and local governments throughout California. Well before the 2007-09 recession, difficulties in funding what have been generally considered adequate public services were common throughout the state, and the SSA was no exception. As described in Chapter 3, the core issue appears to be structural problems in state funding mechanisms, which are likely to remain even as the current and expected economic recovery proceeds. This problem, however, applies not only to the proposed action, but to any development. This section describes the potential impact on tax revenues from the proposed action.

Current uncertainties in potential geothermal lease payments to Inyo County affect whether the proposed action leads to geothermal energy projects that “pay for themselves” in fiscal balances. This issue is important especially in light of the cross-jurisdictional nature of impacts of the proposed action. Inyo County would carry the full cost of road maintenance in the site vicinity, particularly to US 395, but most of the workers for the proposed action would live in Kern County where they would generate sales taxes, property taxes, hotel occupancy taxes, and various other revenues.

Royalty payments are required under the Energy Policy Act of 2005 which calls for 50 percent of the royalties from geothermal leases to be paid to the state, 25 percent to the county in which the lease area is located, and 25 percent to the BLM to operate its geothermal program. Of the monies paid to the state, 40 percent are paid by the state to Inyo County, pursuant to state statute (PRC §3821 and 3823). Numerous attempts have been made to eliminate the 25 percent share going directly to counties, and in the current fiscal year, the 2010 Department of the Interior Appropriations Bill, HR 2996, eliminated such payments to counties for budget year 2010. Local legislators are attempting to reconstitute the direct county share, but the future of the county shares is currently uncertain. Inyo County’s 25 percent direct payment, arising from the Coso Geothermal Project, was \$301,819 in 2007 and \$246,746 in 2008 (Lake County News 2009). In addition, to the direct payments, the state-shared amount paid to Inyo County was \$171,000 (Kevin Carunchio, County Manager, Inyo County, January 4, 2010, personal communication).

The amount of royalties that would be paid as a result of BLM’s proposed action at the HGLA would depend on the market value of energy sales at the time such sales are made. Since those values would not occur until sales are made, and since market values cannot reliably be predicted that far in advance, only a very rough estimate is made herein, based on historical payments to Inyo County by the Coso development. State-shared royalty payments to Inyo County from BLM’s proposed action would be \$41,000 (2008 dollars, which are approximately equal to 2010 dollars). Since the Coso facility is rated at 270 MW, this impact

estimate is based on pro-rating the state-shared payments to Inyo County from the 270 MW Coso geothermal facilities.

Property taxes would also accrue to Inyo County as a result of the proposed action. Based on the estimated construction cost of \$265 million and the local 1% property tax rate, these taxes would amount to \$2.65 million upon operation of both Haiwee geothermal plants. This estimate is in line with the valuation of the Coso plant of \$1.2 billion (Inyo County Register 2008). The actual taxes paid would depend on the County Assessors valuation of sales as operation proceeds, but initially, constructed value would be likely to be the primary basis. In the years before either plant is in operation, assessments value of site improvements would also be made, likely in accordance with the costs of construction shown in Table 4.20-2. Possessory interest values may also be assessed during the earlier exploration and construction phases. The actual valuation of possessory interest, which is essentially the value of having the right to develop¹⁴, is not attempted herein.

Using the IMPLAN model, the total state and local taxes generated by the Proposed Action are estimated to total \$15.8 million over the 2011-2021 time period used for this impact analysis. These estimates would be in addition to property taxes described above. The IMPLAN model does not include taxes for special districts and many other taxing entities, however, many other types of taxes, and therefore these results are considered extremely low-side.

The IMPLAN model does not produce estimates of public costs with which to compare public revenues in order to estimated net fiscal benefits. Such a full fiscal analysis is beyond the scope of this EIS.

Table 4.19-5 IMPLAN Results for State and Local Tax Revenues Generated Under the Haiwee RFD*

Description	Employee Compensation	Indirect Business Tax	Households	Corporations	Totals
Dividends				\$731,300	\$731,300
Social Ins Tax - Employee Contribution	\$44,525				\$44,525
Social Ins Tax -	\$191,560				\$191,560

¹⁴According to the State Assessors Handbook, "...although publicly owned real property is generally either immune from taxation—in the case of federal property—or exempt from taxation—in the case of state and local government property—under certain conditions, the private, beneficial right to the possession of publicly owned real property is subject to separate assessment as a taxable possessory interest" (California State Board of Equalization 2002).

Employer Contribution					
Indirect Bus Tax:					
Sales Tax		\$3,081,709			\$3,081,709
Indirect Bus Tax:					
Property Tax		\$2,455,177			\$2,455,177
	Employee Compensation	Indirect Business Tax	Households	Corporations	Totals
Indirect Bus Tax:					
Motor Vehicle Lic		\$60,892			\$60,892
Indirect Bus Tax:					
Severance Tax		\$1,916			\$1,916
Indirect Bus Tax:					
Other Taxes		\$614,979			\$614,979
Indirect Bus Tax:					
S/L Non Taxes		\$284,104			\$284,104
Corporate Profit Taxes				\$365,366	\$365,366
Personal Tax:					
Income Tax ¹			\$1,772,351		\$1,772,351
Personal Tax: Non Taxes (Fines - Fees)			\$218,867		\$218,867
Personal Tax:					
Motor Vehicle License			\$34,227		\$34,227
Personal Tax:					
Property Taxes			\$15,103		\$15,103
Personal Tax:					
Other Tax (Fish/Hunt)			\$6,309		\$6,309
Sales Tax on Non-local Project Purchases ²		\$5,956,906			\$5,956,906
TOTAL STATE AND LOCAL TAX	\$236,085	\$12,455,683	\$2,046,857	\$1,096,666	\$15,835,291

Footnotes:

*Based on an assumed 2011 to 2021 development period.

(1) Estimated by Economic Planning Resources based on incomes to transient workers and effective state income tax rate of 1% on those incomes.

(2) Estimated by Economic Planning Resources based on estimate of non-local purchases as the residual of total cost minus local project purchases and labor costs.

Source: Minnesota IMPLAN Group, Inc. Economic model used for analysis and RFD analysis by Power Engineers and Economic Planning Resources.

Alternative A – Open the Entire HGLA for Geothermal Exploration, Development and Leasing; Amend the CDCA Plan to have the HGLA Open and Available for Geothermal Exploration, Development and Leasing; Authorize All Pending Leases Within the HGLA

Under Alternative A the CDCA Plan would be amended to reflect the delineated HGLA as open to geothermal leasing for direct and indirect use, and 22,805 acres of BLM-administered lands or federal mineral estate would be made available for geothermal exploration, development, and utilization. Groundwater extraction for consumptive use during exploration, development, and production would be allowed, but controlled or restricted by stipulation. Limited groundwater use may be allowed under certain conditions specified in Chapter 2 and in SA-HGLA-10. Under this alternative the BLM would authorize the three pending non-competitive lease applications for 4,277 acres.

The foreseeable and potential socioeconomic impacts associated with Alternative A are discussed above. The data show that impacts to Inyo and surrounding counties from implementation of the Haiwee RFD will likely be an increase in employment (including secondary employment), economic benefits, and public revenues (as a result of royalty payments and property taxes). Other potential impacts may include a decrease in available housing or public services and are expected to be low and short-term based on the characteristics of the exploration and construction work force, and those of the long-term operations work force.

Alternative B– Close the Entire HGLA to Geothermal Exploration, Development and Leasing; Amend the CDCA Plan to have the HGLA Closed and Unavailable for Geothermal Exploration, Development and Leasing; Deny Authorization of All Pending Leases Within the HGLA

Under Alternative B, BLM-administered lands located within the HGLA would be closed to geothermal leasing, and the CDCA Plan would be amended to reflect that decision. Under this alternative the BLM would not offer competitive geothermal leases on any of the 22,805 acres of BLM-administered lands or federal mineral estate within the HGLA, and would deny the three pending non-competitive lease applications.

Under Alternative B there would be no socioeconomic or land use changes as a result of geothermal leasing in the HGLA or the greater CDCA.

Alternative C – Open the HGLA to Geothermal Exploration, Development and Leasing; with No Surface Occupancy (NSO) Allowed in Sensitive Areas; Amend the CDCA Plan to have the HGLA Open and Available

for Geothermal Leasing; Authorize All Pending Leases within the HGLA

Under Alternative C, the CDCA Plan would be amended to reflect the delineated HGLA as open to geothermal leasing for direct and indirect use, but with specific acreages of the HGLA under restrictions of the No Surface Occupancy (NSO) stipulation NSO-HGLA-1. In addition, based on public concerns regarding the use and limited availability of groundwater, groundwater extraction for consumptive use would be prohibited. Under this alternative, the BLM would also authorize the three pending non-competitive lease applications for 4,277 acres.

Impacts associated with Alternative C would be equal to or less than those of Alternative A because Alternative C would be essentially the same as the Alternative A in regards to the RFD scenario. Since the socioeconomic impacts of Alternative A were assessed as low, and the development likely to occur under Alternative C would be less than or equal to (but not greater than) those of Alternative A, the socioeconomic impacts of Alternative A are assessed as low.

Alternative D – Selective Closure of Sensitive Resource Areas within the HGLA for Geothermal Exploration and Development; Amend the CDCA Plan to have Designated Areas within the HGLA Open and Available for Geothermal Leasing; Amend the CDCA Plan to have Designated Areas within the HGLA Closed and Unavailable for Geothermal Leasing; Authorize All Pending Leases Within the HGLA

Under Alternative D, the BLM would close specific areas within the HGLA to geothermal leasing to protect sensitive resources while opening the remainder of the HGLA to leasing. Of the 22,805 acres of BLM managed lands or federal mineral estate within the HGLA, 13,773 acres would be closed and the remaining acres would be open in this alternative. In addition, based on public concerns regarding the use and limited availability of groundwater, groundwater extraction for consumptive use would be prohibited. The CDCA Plan would be amended to reflect the specific areas that are open and closed to geothermal exploration, development, and utilization. Under Alternative D, the BLM would also authorize the three modified pending non-competitive lease applications for 4,277 acres.

The socioeconomic impacts under Alternative D would be similar to those described for Alternative C, and would be assessed as low.

Alternative E – No Action

Under the No Action Alternative, the CDCA Plan would not be amended, and the existing plan decisions, stipulations, and allocations would not change as a direct result of this EIS process. The HGLA would remain under management of the current CDCA Plan, which does not identify the HGLA as open or closed to geothermal leasing, nor does it indicate the availability status of lands within the HGLA. The three pending lease applications would be denied.

Alternative E would not result in either positive or negative socioeconomic impacts because no geothermal development would occur within the HGLA under present CDCA Plan policies and guidelines.

4.20 CUMULATIVE IMPACTS

4.20.1 Introduction

CEQ regulations require that an EIS address cumulative impacts, which are defined as:

“...the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.” (40 CFR 1508.7).

Cumulative impacts may result in significant impact to the environment, as degradation of important resources may result from the combined, incremental impacts of actions. Cumulative impacts can result from similar projects or actions, as well as projects or actions that have similar impacts.

The HGLA cumulative impacts analysis focuses on the natural resources, ecosystems, and social or human communities that could be affected by the incremental impacts from development of geothermal resources that might be associated with adoption of one the HGLA alternatives as evaluated in Chapter 4. This analysis builds on the direct and indirect impacts of the alternatives described in Chapter 2 of the EIS. The approach to the cumulative impacts analysis follows the principles outlined in the CEQ’s *“Considering Cumulative Impacts”* (1997) and USEPA and Office of Federal Activities guidance entitled *“Consideration of Cumulative Impacts in EPA Review of NEPA Documents”* (1999).

4.20.2 Methodology

The BLM followed the steps below to develop the cumulative impacts analysis for the EIS:

Step 1: Define alternatives for the EIS.

The proposed action and alternatives are described in Chapter 2 of the EIS. Consideration of the impacts of past actions has been carried out as an integral part of the evaluation of the baseline, or affected environment defined and described in Chapter 3, and is reflected in the alternatives presented, as well as subsequent analysis.

Step 2: Define Present and Reasonably Foreseeable Future Projects and Actions.

A list of present and reasonably foreseeable actions was developed via consultation with government agencies, nongovernmental organizations, and knowledgeable private

entities, as well as through public scoping. These actions included projects, activities, and trends that could impact the human and environmental resources in each impact area.

Step 3: Incorporate the Direct and Indirect Impacts.

Direct and indirect impacts associated with geothermal development according to the RFD developed and evaluated elsewhere in the EIS are incorporated into the cumulative impacts analysis. Direct impacts are caused by implementing the proposed action or an alternative, and occur at the same time and place as the proposed Project. Indirect impacts are caused by the proposed action or an alternative, but are later in time or farther removed in distance and are still reasonably foreseeable.

Step 4: Determine the Potential Impacting Factors of Each Past, Present or Reasonably Foreseeable Future Project and Action.

For each action identified in Step 2, the BLM developed a description of the potential impacting factors, which are the mechanisms by which an action affects a given resource. Each impacting factor may be a component of more than one action or activity.

Step 5: Evaluate Cumulative Impacts.

The BLM evaluated cumulative impacts for each resource. The scope of the impact analysis was determined in Chapter 3 as described for each resource. The evaluation considers the impacting factors for the various resources and the incremental contribution of the proposed action to the cumulative impact.

- The following factors are used to judge the cumulative impact on a resource:
- Nature of the impact;
- Geographic or spatial extent of the potential impacting factor;
- Geographic or spatial extent of the resource;
- Temporal extent of the potential impacting factor;
- Regulatory considerations, for example, threatened and endangered species;
- Potential for effective mitigation of the impact; and
- Potential for recovery of the resource after removal of the impacting factor.

Step 6: Present the Cumulative Impacts Analysis.

The cumulative impacts for each resource are described in this Section of the EIS.

4.20.3 Past, Present and Reasonably Foreseeable Future Projects and Actions

The following discussions describe present and reasonably foreseeable future projects and actions in and around the HGLA, including renewable energy, water, highway, and mineral development projects. The analysis takes into account the effects of past actions, as represented by the baseline –the affected environment, as well as the impacts of the “no action” alternative. When combined with the impacts from the project alternatives, these projects and actions may contribute to cumulative impacts. While a distinct impact area for cumulative impacts and specific present and reasonably foreseeable future projects and actions are determined individually for each resource, collectively, the projects described below represent the major known and anticipated activities that might occur in the HGLA’s vicinity.

As the discussions include projects in various stages of planning and development, it is likely that some of these projects will be completed as currently proposed while others will not. To be conservative, the cumulative impacts analysis assumes that all of the following projects will be built and in operation during the development and operating lifetime of the geothermal projects outlined in the HGLA RFD scenario. The BLM consulted the following agencies to identify the projects:

- BLM – Ridgecrest Field Office;
- BLM – State Office;
- BLM – California Desert District;
- China Lake Naval Air Weapons Station (NAWS);
- Coso Operating Company;
- Inyo County Planning Department; and
- Los Angeles Department of Water and Power (LADWP)

Renewable Energy Projects

Renewable energy resources and projects are present throughout the HGLA region. Geothermal exploration-related facilities in the HGLA cumulative affects area have been approved by the state, BLM, and Inyo County, for example the Deep Rose Geothermal Exploration Project. The Coso Geothermal complex generates power on the China Lake NAWS. Several hydroelectric power generation facilities are located in the Owens Valley. Electricity generated at these facilities is generally routed towards population centers to the south, on transmission lines in the Owens Valley, or lines leading south from the Coso complex through the Naval Station and the Ridgecrest area. The West-wide Energy Corridor Programmatic EIS identifies energy corridors through the Owens Valley. The Renewable

Energy Transmission Initiative has also identified similar corridors. Additional transmission upgrades into and through the Owens Valley have been discussed for geothermal energy development in Western Nevada.

Geothermal Energy Projects

Deep Rose Geothermal Exploration Project

Deep Rose, LLC has obtained the necessary approvals to explore geothermal resources in southern Inyo County. The area of exploration is located near the center of the HGLA on state-owned lands in the southern McCloud Flat region in Section 16, Township 21 South, Range 38 East, Mount Diablo Base and Meridian (see Figure 2.1-1). They have received a BLM right-of-way to build a road for access to the proposed drilling site in Section 16 and to build a water pipeline should development occur. If a resource is located, Deep Rose, LLC would likely apply for permits for geothermal development.

Coso Geothermal Leasing Area

The Coso Geothermal Field is located in the NAWS, just to the east of the HGLA. The field's reservoir is in a Mesozoic granitic/metamorphic complex underlying the Quaternary Coso Volcanic Field. It currently produces approximately 200 MW from four geothermal plants. More than 100 wells have been drilled throughout the field, with production depths from 2,000 to 12,000 feet, and geothermal resource temperatures from 200° to 350°C (see Figure 2.2-1).

In 1987, the Coso Geothermal Field began generating electricity. Since then, improvements have resulted in more efficient use of the resource. Together with an annual drilling program, these improvements have helped keep the geothermal field producing above its contract capacity of 210 MW. Improvements to the field's injection system and injection augmentation are described below for the Hay Ranch project.

Solar Energy Projects

Currently, the California Energy Commission (CEC) is reviewing two proposed solar projects: the 2,012-acre Beacon Solar Power Project and the 3,920-acre Ridgecrest Solar Power Project. Both projects are located in northeastern Kern County.

Interest has also been expressed in solar energy development at the following locations:

Hay Ranch, about 700 acres near Coso Junction along U.S. Highway 395 – Terra-Gen Power LLC;

McNaughton Property, 1,400 acres east of Independence – AEI CASC Consulting;

Lone Pine Tribe, south of Lone Pine;

Wiley Trust properties, 7,000 acres in Charleston View;

Owens Lake, 57,600 acres; and

Owens Valley, 175,000 acres on LADWP lands

Wind Energy Projects

The BLM's Ridgecrest Field Office received applications from the following companies for initial exploration studies for two wind energy developments in southern Inyo County. These projects are located in and adjacent to the HGLA and would initially involve installing MET towers.

Debenham Energy LLC

16,364 acres on east and west sides of U.S. Highway 395 and Haiwee Reservoir in southwestern Inyo County, up to eight towers. This application has been withdrawn and is no longer pending.

RES America Developments

Environmental documents expected for the following two meteorological assessments for wind energy projects along U.S. Highway 395 in southwestern Inyo County: (1) Little Lake North – 13,754 acres, six towers; and (2) Little Lake South – 4,000 acres, three towers (see Figure 2.1-1).

Other Relevant Projects and Actions

A description of several other notable projects in the vicinity of the HGLA is included in this section. These projects have the potential to contribute to cumulative impacts when considered with the proposed action.

Los Angeles Department of Water and Power Haiwee Reservoir Seepage Recovery

The LADWP's North and South Haiwee Reservoirs are unlined and may leak water that infiltrates to the groundwater table. The amount of leakage is unknown. LADWP reportedly estimated the leakage rate to be approximately 900 acre-feet per year, based on the model calibration effort conducted for the 2006 numerical groundwater flow model. LADWP has stated that it will propose a future seepage recovery project that would pump the groundwater from an existing LADWP well (V817 or V816) just north of Hay Ranch through a 1,700-foot-long pipeline to the Los Angeles Aqueduct to the west. The well would be pumped at approximately 1.2 cubic feet per second, approximately 870 acre-feet per year. The area

encompassed by the South Haiwee Reservoir and associated facilities extends approximately 2.5 miles south of the reservoir and adjacent to the northeast boundary of the HGLA.

Hay Ranch Water Extraction and Delivery System

The Coso Operating Company, LLC has recently constructed a groundwater extraction and pipeline delivery system from the Coso Hay Ranch to the water distribution station and injection system located at the Coso Geothermal Field. The project included an approximately nine-mile-long pipeline within a 50-foot-wide right-of-way across public lands located in the HGLA. The pipeline was constructed to convey water to the Coso Geothermal Project for supply of injection water to replace geothermal fluid that is evaporating from the geothermal project's cooling towers during the summer months. In addition to the pipeline, the project includes an associated electric power substation, pumping equipment, and holding tanks. Six acres of the project is located on private property, 32 acres are on BLM-managed public lands, and 16 acres are located on the China Lake NAWS (see Figure 2.1-1).

U.S. Highway 395 Improvement Projects

Caltrans has various improvement projects located along or on U.S. Highway 395. Most applicable in this analysis is the safety roadside rest area rehabilitation project at Coso Junction. In October 2008, Caltrans completed this rehabilitation project.

Gill Station Road Improvements

The Inyo County Department of Public Works proposes to improve a 5.5-mile-long section of Gill Station Road (also known as the Coso-Gill Station Road), from U.S. Highway 395 at Coso Junction to the China Lake NAWS' entry gate, just east of the HGLA boundary. The project would include realigning, widening, and repaving Gill Station Road.

Haiwee Ridge Pump Storage Project

Haiwee Ridge Hydro, LLC has proposed a 500 MW pump storage project involving a manmade reservoir in the Coso Mountains and water from the South Haiwee Reservoir. A Preliminary Permit has been requested from the Federal Energy Regulatory Commission. The proposed facility would purchase water from the Los Angeles Department of Water and Power to generate power during times of peak demand. The current proposal encompasses about 7 ¼ sections (approximately 4,640 acres) of BLM managed lands within the HGLA.

Mineral Development

Currently, pumice is the primary economically viable mineral resource in the area. There are many potential mineral development projects in the HGLA cumulative effects area.

4.20.4 Cumulative Impacts by Resource

Air Quality

Cumulative impacts on air quality must take into account past, present, and reasonably foreseeable actions and activities to evaluate whether the proposed project would have a cumulative effect on air quality.

Air quality impacts of past and present projects that are currently operating in the vicinity of the HGLA are accounted for in background concentrations of air pollutants as measured at the air monitoring stations located in Death Valley, Olancho, and Keeler. Table 3.2-3 summarizes these concentrations. The currently operating projects are also accounted for in the attainment status of the air basin, and attempts to quantitatively evaluate the cumulative construction and operating emissions would be speculative.

Cumulative construction impacts to air quality could result if construction activities for the projects above would occur simultaneously with construction in the HGLA. It is unlikely that all of the projects would be constructed at the same time. Quantitatively evaluating cumulative construction emissions would be speculative. During construction, all projects would be required to implement fugitive dust control measures to minimize cumulative impacts.

Cumulative operational impacts to air quality would result if cumulative projects that result in air emissions during operations have a significant impact on air quality. Through the air permitting process with the GBUAPCD, projects with operational emissions that degrade air quality would not be allowed. Most of the renewable energy projects identified above involve development of solar and wind projects, which, once constructed, result in minor amounts of air emissions from inspection and maintenance activities. Potential mineral development in the HGLA also has the potential for air emissions from operations associated with mineral extraction processes. However, as mentioned above, the cumulative impact from geothermal development in the HGLA to air quality is considered negligible. As such, combining the other existing or planned projects and activities in the HGLA with those related to geothermal development in the HGLA would result in negligible increases to air quality standards.

Noise

The cumulative impact of development in and around the HGLA would generate short-term, local noise. The majority of this noise would be expected to originate from the projects mentioned above. More specifically, should the CEC approve the two proposed solar energy projects on private land, the noise that these projects' construction vehicle and personal vehicle traffic streams would produce would add to that of the HGLA-related vehicles. The solar energy projects' on-site construction activities would also add to HGLA construction

noise. While it is unlikely that all of the projects would occur at the same time, construction vehicle, personal vehicle, and construction noise associated with Debenham Energy's proposed wind project would occur on both sides of U.S. Highway 395 and could add to the solar and geothermal projects' noise levels. Additionally, traffic and construction-related noise associated with RES America Developments' proposed wind project on 17,754 acres at Little Lake would be expected to impact a residential property situated less than one-half mile north of Little Lake. Furthermore, the Inyo County Department of Public Works' proposal to realign, widen, and repave a 5.5-mile section of Gill Station Road would also be expected to contribute to an increase in ambient noise levels.

It is important to note that the cumulative noise from multiple sources, such as well-drilling and grading equipment from both on- and off-site developments, is determined based on the addition of sound intensities from the sources instead of the addition of their sound pressure levels. The combined noise level of multiple sources is the logarithmic sum of the sound intensity of each source. For example, two construction equipment noise levels of 90 and 45 dBA result in a combined audible noise level of approximately 90 dBA. Drilling and testing wells would subject persons in close proximity to intermittent loud noises. However, none of the projects mentioned above would generate long-term, local noise.

Topography, Geology, and Seismicity

The cumulative impact of implementing the geothermal, wind, and water projects above, along with the proposed action or alternatives, would be expected to create local changes in topography and geology, and potentially increase micro-seismicity. Though the exact locations for any future developments are unknown, it would be expected that many of the projects would likely occur on relatively level terrain, which would minimize the need for cut and fill. However, should projects be proposed on terrain with relatively high relief, then those projects would require specific mitigation to address erosion, slope stability, and seismicity. The pump storage project, if completed, would clearly impact topography by the creation of a reservoir with its associated dams.

Concerning geology and seismicity, exploration and construction activities specific to the geothermal and wind projects would be expected to create local changes in these resources. However, the cumulative impacts to these resources in the HGLA and adjoining areas are expected to be minor. While geothermal projects proposed by Deep Rose LLC and BLM lease applicants would impact the HGLA's geology and add to the Coso Geothermal Field's impacts, these projects are not expected to create regional geological impacts or trigger seismic events. Similarly, the Coso Operating Company's recently completed pipeline and wind proponents' excavation and installation activities for wind tower foundations and placement are also not expected to create regional geological impacts or trigger seismic events.

Soils

Combining the anticipated impacts associated with the proposed action with impacts from other potential projects and activities in the area may create additive soil impacts. This combination of impacts could potentially generate other impacts such as increased sedimentation of waterways, impacts to aquatic species, deterioration of visual quality from fugitive dust during high wind events, liberation and suspension of particulate matter, and loss of topsoil to allow vegetation growth.

The probable increase in miles of new roads in the HGLA, as well as surrounding areas, from geothermal development and other projects and activities could result in an increase in OHV traffic, which would lead to increased soil erosion, especially during intense rainfall events. Unless properly mitigated and depending on the locations of the RFD facilities, the cumulative disturbance of soils from other projects could potentially contribute sedimentation to Haiwee Creek, Little Lake, and Haiwee Reservoir. However, it is anticipated that the cumulative impacts of soil erosion or sedimentation would be minor because of the generally required implementation of mitigation measures and lack of significant rainfall throughout the year. Flash flood events do cause significant erosion but, given the sparse existing vegetation cover, impacts from these natural events would not be exacerbated by the proposed activities in the HGLA. The cumulative impacts of activities associated with development in the HGLA would have a minor increase in soil erosion or sedimentation.

Water Resources

Other relevant groundwater extraction projects that may contribute to cumulative water resources impacts in the HGLA include the Coso geothermal plant, Hay Ranch Groundwater Extraction and Delivery System, Deep Rose Geothermal Exploration, and LADWP capture of groundwater seepage from the South Haiwee Reservoir. The cumulative impacts of implementing one or more groundwater development projects in Rose Valley depends on the pumping rate, project duration, extraction location, and schedule relative to other groundwater development projects in the valley. As discussed above, additional water would likely be needed to sustain operation of the RFD assumed geothermal plants during a 30-year useful life. At least some of the water supply would likely come from groundwater extraction in the Rose Valley, which is also being used for operation of the Coso geothermal plant. Though these pending projects might be required to extract any groundwater from outside the HGLA, they would be the largest users of groundwater in Rose Valley. Based on the calculated recharge rates and observed impacts at the Coso geothermal facilities, the combined groundwater withdrawal is predicted to cause the lowering of the groundwater table and decrease in water available to wells, wetlands, and Little Lake. Since all

alternatives proposed tie water consumption to the safe yield in the basin, it is unlikely that any geothermal leasing will negatively impact water resources.

Geothermal Well Drilling, Plant Construction, and Dust Control

Low to moderate short-term impacts are expected from groundwater extraction to support geothermal well drilling, facilities construction, dust control, and other minor water needs associated with geothermal exploration and development under the HGLA RFD scenario. This prediction is based on the generally short-term nature of well drilling or construction activities, likely minor water needs associated with individual well drilling projects, or routine dust control measures, and, the apparent lack of significant impact from comparable current activities including groundwater extraction for domestic uses in the valley and groundwater extraction for the surface mining operations in the valley.

In the event that a number of concurrent geothermal drilling or construction projects are undertaken in the valley, cumulative impacts could be more significant. It should be noted that groundwater extraction for the Hay Ranch groundwater diversion project, which has started operation at an initial extraction rate of approximately 3,000 acre-feet per year, is not expected to reduce groundwater flow towards the Little Lake Ranch property at the south end of the valley by more than 10 percent. 10 percent was identified as a critical protective threshold in the draft EIR (MHA 2008) so that stipulations are in place curtailing pumping if certain drawdown triggers are reached in nearby wells. This same protective threshold is included in all of the action alternatives that authorize leases.

The estimated amount of groundwater needed for a geothermal well drilling project is approximately 12 acre-feet (ac-ft) of water per well. This amount is considerably less than the extraction rate of 790 ac-ft/yr estimated via the Revised Groundwater Flow Model (Stephens & Associates 2011) to be sustainable for the Hay Ranch groundwater diversion project. In this way, it appears that wells could be drilled without measurable impacts to groundwater resources.

Extraction to Augment Geothermal Reservoir Fluid Levels

In contrast to the projected low impacts from geothermal well drilling and similar short-term projects, long-term extraction to augment geothermal reservoir fluid levels would likely have significant impact on sensitive receptors and, in particular, to surface water features at the south end of the valley on the Little Lake Ranch property. The Hay Ranch groundwater diversion project is currently operating at a permitted extraction rate of 3,000 acre-feet per year, comprising a significant fraction of the estimated 5,100 acre-feet per year annual recharge to the Rose Valley aquifer. In addition, LADWP has a proposal to extract approximately 870 acre-ft of groundwater on property they own at the north end of Rose Valley. The timeframe for the LADWP project has not been identified. As discussed above,

potentially significant impacts to the groundwater resources of Rose Valley are predicted for even modest long-term pumping to augment geothermal reservoir fluid levels.

Appendix G presents a groundwater flow modeling analysis. Results indicate that groundwater extraction for just one or two geothermal plants would likely reduce groundwater flow to Little Lake Ranch. This extraction would exceed the 10 percent flow reduction threshold identified in the HMMP for the Hay Ranch project (MHA 2008). The analysis presented in Appendix G indicates that a 30-year pumping rate of approximately 1,150 acre-feet per year could be sustained. This rate would not reduce groundwater flow to Little Lake by more than 10 percent, absent any other extraction projects. The analysis also indicates that drawdown from multiple extraction projects is additive, depending on the location and timing of the extraction. Considering the Hay Ranch project, it is unlikely that significant long-term groundwater extraction, without restraints, can be sustained without impacting the surface water at Little Lake Ranch. Therefore, the water production stipulations of the action alternatives should minimized long term impacts from geothermal development and make them minor.

Biological Resources

Several developments have already disturbed or removed vegetation communities in the HGLA. These developments include roads, transmission lines, the Coso Geothermal complex, the Hay Ranch water pipeline project, and grazing. In addition to these developments, it is highly likely that planned renewable energy projects would disturb or remove additional vegetation communities in the region. Should the planned renewable energy projects be constructed, they would alter the landscape of the undeveloped desert. The increased traffic and ground disturbance associated with these planned projects might also introduce non-native, invasive weed populations to the HGLA and adjoining areas. Furthermore, the West-wide Energy Corridor Final Programmatic EIS (DOE 2008) identified a portion of the HGLA as a utility corridor, raising the possibility that future transmission projects could also be developed in the area.

Non-native, invasive weed populations not only displace native plants, but can also impact wildlife. More specifically, these weed populations can degrade the quality and quantity of forage available to native wildlife. In this way, wildlife habitats may become fragmented and degraded. Fragmentation causes the core wildlife area size to decrease and reduces the patches that are uninterrupted by human disturbance. As fragments increase, edge areas increase. This phenomenon reduces habitat connectivity, may favor the habitat generalist wildlife species over the desert-adapted species, and could threaten species richness or diversity at regional scales (Rogers et al.1996). However, based on the limited amount of habitat modification relative to the total HGLA acreage, fragmentation and loss of habitat is not expected to significantly impact the diversity or abundance of the HGLA fauna.

Concerning listed species, the accelerated loss of habitat, combined with the increased potential for losses of burrowing or slow-moving species, such as the Mojave ground squirrel and desert tortoise, would represent the most significant cumulative impact from the HGLA RFD and other nearby developments. Development consistent with the proposed action, in conjunction with other projects, would diminish habitat availability and quality, and potentially result in the “taking” of these species. Stipulations, permitting requirements, and agreements between the California Department of Fish and Game and the BLM, including compliance with Section 7 of the ESA, could minimize such impacts. However, other existing and proposed developments, such as solar energy projects, typically impact and alter thousands of acres and thus can have significant impacts to local populations of listed plant and wildlife species. The increase in the associated number of roads and transmission lines would result in additional losses from collisions.

Cultural Resources

As mentioned above, various renewable energy projects are being planned in and around the HGLA. Depending on whether these projects are on federal, state, or private land, they would be subject to either Section 106 of the NHPA or CEQA regulations. In accordance with either Section 106 or CEQA, project proponents would assess project-related effects on archaeological and historical resources. Table 4.20-1 summarizes the types of potential effects associated with different projects. In many cases, implementing BMPs and mitigation measures into the project’s design can reduce or eliminate effects on significant cultural resources. However, cumulative impacts to cultural resources could still result from the gradual and incremental loss of cultural resources across the region.

Table 4.20-1 Types of Potential Effects on Cultural Resources

Project	Potential Visual Impact	Potential Ground Disturbance Impacts
Coso Geothermal Leasing Area	Height of facilities	Road grading, vegetation clearing, drilling, facility construction
Deep Rose Geothermal Exploration Project	Height of facilities	Road grading, vegetation clearing, drilling, facility construction
Debenham Energy Wind Energy Project	Height of wind turbine generators	Road grading, vegetation clearing, geotechnical drilling, turbine foundations
RES America Wind Energy Project	Height of wind turbine generators	Road grading, vegetation clearing, geotechnical drilling, turbine foundations
Haiwee Reservoir Seepage Recovery	Limited	Trenching for pipeline
Hay Ranch Water Extraction and Delivery System	Limited	Trenching for pipeline
North Haiwee Dam Replacement Project	Limited	Various construction activities
U.S. Highway 395 Improvement Projects	Limited	Road grading, vegetation clearing
Gill Station Road Improvements	Limited	Road grading, vegetation clearing
Teal/Cal Lightweight Pumice Mine	Height of facilities	Road grading, vegetation clearing, excavation

Paleontology

Federal land-holding agencies, such as the BLM, are in the process of developing regulations to implement the recently passed Paleontological Resource Protection Act (PRPA). In California, CEQA requires consideration of impacts to paleontological resources on state and private land. Paleontological resources are abundant in areas near the HGLA, so it is possible that past, present, and reasonably foreseeable future projects and actions in southern Inyo and northern Kern counties could impact these resources. However, the HGLA has a low potential for containing paleontological resources, and impacts from the proposed action are not likely. In this way, the proposed action or alternatives would not contribute to other projects' cumulative impacts on paleontological resources.

Visual Resources

Geothermal development in the HGLA, combined with other energy projects, could potentially alter the existing landscape in a number of ways, including negatively affecting sensitive viewers and the scenic quality of the landscape. Potential projects that may contribute to cumulative visual impacts include geothermal energy, solar energy, and wind energy developments as well as new roadway and transmission lines or upgrades.

Geothermal development in the HGLA and such other projects could increase the number of visible man-made structures in an area where such alterations to the landscape are generally absent, thus reducing the undeveloped nature of the landscape. They could also introduce elements such as night lighting and cooling tower plumes that would disrupt the existing visual environment.

Cumulative impacts to the scenic quality of the landscape could result from the combined visual contrast of multiple projects caused by visible structures, vegetation clearing, and ground disturbance impacting the existing landscape character and diminishing the overall aesthetic appeal of an area.

Impacts to sensitive viewers at viewpoints such as communities, recreation and preservation areas, travel corridors, and cultural sites could result when the visual contrast of multiple projects across the landscape is observed. The sensitive viewpoints identified in the HGLA and vicinity are typically stationary viewpoints where cumulative impacts would occur if the combined contrast of multiple projects across the landscape is observed in a single vista. However, cumulative impacts to sensitive viewers traveling along the U.S. Highway 395 corridor could also result if multiple projects were observed in succession along the corridor, substantially altering the viewer's visual experience.

Meteorological assessments for wind energy development are underway in southwestern Inyo County along U.S. Highway 395. Wind monitoring projects are speculative. However, if wind energy projects are constructed, the resulting turbines, transmission lines, vegetation clearing, and ground disturbance could contribute to cumulative visual impacts to sensitive viewers traveling along U.S. Highway 395. Cumulative visual impacts could also occur for Little Lake Overlook, Fossil Falls, and the Haiwee trailhead. Cumulative impacts could occur for additional sensitive viewers who may have more distant views of wind energy projects. However, these potential impacts are expected to be low.

Interest has been expressed in solar energy development at Hay Ranch, near Coso Junction along the highway. If a solar energy project is constructed, solar collection components, transmission lines, vegetation clearing, and ground disturbance could contribute to cumulative visual impacts to sensitive viewers traveling along U.S. Highway 395 and to the community of Coso Junction. Cumulative impacts could occur for additional sensitive viewers who may have more distant views of solar energy projects. However, these potential impacts are expected to be low.

The existing Coso Geothermal complex's cooling tower plume, along with other energy projects' cooling tower plumes, may contribute to cumulative visual impacts to sensitive

viewers. Viewers in nearby communities along U.S. Highway 395, and in recreation and preservation areas could have views of cooling tower vapor plumes, depending on the location of the facility and atmospheric conditions. Typically, the closer facilities are located to sensitive viewpoints, the greater the dominance of the vapor plume in the visual setting, and the greater the potential impacts that may result.

Agency management objectives may not be met due to the cumulative impacts of multiple projects. The cumulative impacts of the proposed action and other planned or potential projects are not likely to meet the VRI/VRM Class II objective, which seeks to retain the existing character of the landscape. Similarly, the cumulative impacts may not meet the VRI/VRM Class III objective, which seeks to partially retain the existing character of the landscape. However, implementing the BMPs described in Chapter 2 and Appendix A would likely reduce the cumulative impacts to a level that would meet the VRI/VRM Class III objective.

To meet the VRI/VRM Class III objective, mitigation measures may include locating facilities and related disturbance so as not to dominate the landscape, and at the maximum distance from sensitive viewpoints. Additional measures to minimize cumulative impacts would include co-locating pipelines and transmission lines, particularly with existing linear facilities.

Lands and Realty

Cumulative impacts from management of lands and realty are limited to direct on-the-ground impacts to other resources such as visual quality, water quality, and biological resources. Therefore, leasing of geothermal resources in the HGLA would not have a cumulative impact on the HGLA's land and realty resources.

Public Health and Safety

Regardless of which project or action is implemented, if project proponents follow all applicable health and safety regulations, cumulative impacts to public health and safety are expected to be negligible. Though there is a potential for hazardous spills, BMPs would contain the spills, which would not be large enough to combine with spills at other project sites. The potential for cumulative impacts from the hazardous or solid wastes produced by Alternatives A, C, and D would be minimal.

Mineral Resources

Currently, pumice is the primary economically viable mineral resource in the area. Cumulative impacts to this mineral would occur if developmental impacts associated with the proposed action are combined with impacts of other renewable energy projects. Though it is unlikely that all of the proposed/potential renewable energy projects in the region would be

constructed, it is reasonable to assume that some of the projects would be constructed. Should the BLM lease land for geothermal energy project development, it might limit future mineral development in the HGLA. Other activities proposed in the area might also limit certain mineral development opportunities. However, because pumice exists throughout the region, the cumulative impact to this mineral resource is expected to be minimal, regardless of whether the proposed action, alternatives, or the other projects and actions mentioned above are implemented.

Wild Horses and Burros

Based on the level of occurrence of wild horses and burros in the HGLA, and availability of appropriate stipulations and BMPs, any cumulative impacts to wild horses and burros from geothermal leasing and other future developments would be expected to be negligible.

Grazing

The cumulative impact to grazing allotments depends on the location(s), size(s), and type(s) of renewable energy project(s) that might be constructed. In implementing the proposed action or alternatives, the amount of land that might be leased is small compared to the amount allotted for grazing. In this way, the acreage available for grazing and the number of livestock are not expected to be reduced significantly. Should additional geothermal projects be constructed in the region, the cumulative impact could create conditions whereby ranchers no longer view grazing as an economically viable operation. Ranchers might then retire grazing agreements and relocate operations to another area. However, royalties that leaseholders pay to ranchers may lessen the economic burden of relocating grazing operations.

Concerning solar and wind energy projects, it is unlikely that proponents would construct all of the projects mentioned above. However, it is important to note that the amount of land required for these projects would be 12 times greater than the amount forecast in the HGLA RFD scenario. Should only the Beacon and Ridgecrest solar projects along with Debenham Energy's and RES America Development's wind projects be constructed, in total, these projects would require 78 percent more land than the HGLA RFD scenario. Whether these solar and wind projects are constructed alone, or in addition to the proposed action or alternatives, they would be expected to create greater economic losses for ranchers than geothermal projects alone.

Recreation

The cumulative impact of implementing the proposed action, alternatives, or any of the other projects and actions mentioned above, would be expected to diminish the public's access to passive and active recreation in and around the HGLA. More specifically, most of the indirect impacts to recreation from the proposed action and Alternatives C and D concern

possibly limiting access, disturbing wildlife, and reducing recreational enjoyment. Wildlife gathering areas would be subject to these impacts, which might reduce the public's ability to enjoy these areas for photographing nature and viewing wildlife.

In California, OHV popularity continues to increase, while legal opportunities for OHV recreation continue to decrease. As the pressure to develop land increases, the amount of land available for OHV use is expected to decrease. Implementing any of the projects and actions mentioned above, alone or in combination with other land development activities, might compel OHV enthusiasts to seek out new places to recreate. In this way, such a shift could overcrowd other existing recreation areas, adversely impact previously undisturbed areas that might include sensitive plant and wildlife habitat, and/or lead OHV enthusiasts to use undeveloped, vacant land illegally. New routes created by geothermal projects might create new might require a CDCA plan amendment for route designation. Also, BLM law enforcement may need to focus more staff in patrolling the HGLA so that the safety of recreation visitors and the geothermal infrastructure is secured and so that the natural resources are not further impacted by unauthorized travel off designated BLM trails. However, implementing appropriate mitigation measures would be expected to reduce cumulative impacts to passive and active recreation resources.

Special Designations

Local government officials in Inyo and Kern counties would be expected to minimize cumulative impacts to special designated areas in their jurisdictions. More specifically, local government officials would require any project proponent to comply with the terms and conditions of all applicable local land development regulations, permits, and development agreements, and respect site-specific management policies. In this way, the cumulative impacts to special designated areas would be expected to be minimal.

Traffic/Transportation

With regard to impacts to the existing traffic and transportation systems it is important to identify past, present, and reasonably foreseeable future projects and actions that, when added to the projected impacts from geothermal development in the HGLA above, could provide additional impacts to the transportation network and traffic flows in and around the HGLA. However, such actions, as presented below, would not be expected to degrade the levels of service to below acceptable levels along the roadways of southwestern Inyo County and northeastern Kern County. More specifically, further development in the Coso geothermal development area and the Deep Rose geothermal exploration area would introduce construction vehicles and personal vehicles to U.S. Highway 395 in the vicinity of the HGLA. Yet, according to Inyo County's 2009 Regional Transportation Plan, the county has programmed funding to reconstruct Gill Station-Coso Road. Reconstructing this road would help mitigate impacts associated with an increase in construction and personal vehicle traffic en route to and from the Coso geothermal area.

In addition, the California Department of Transportation plans to widen U.S. Highway 395 to a four-lane facility in Independence, and between Olancho and Cartago (Inyo County 2009). Such a project would help mitigate the increase in construction vehicle and personal vehicle traffic associated with developing the RFD scenario in the HGLA.

Finally, one of Kern County's goals is to develop additional access points to the NAWS, if deemed necessary by Navy officials (Kern County 2007). Providing more access to this naval facility could help reduce the amount of traffic along U.S. Highway 395.

Socioeconomics

Cumulative socioeconomic impacts could occur if multiple projects increase populations, which could impact housing, public services, local public finances, or low-income and minority populations. The following analysis describes cumulative impacts that might occur should the HGLA RFD scenario be combined with other renewable energy projects and non-energy-related construction projects.

HGLA RFD Scenario

The RFD scenario's socioeconomic impacts would be minimal. However, more significant impacts might occur if multiple projects are constructed during the same time period and/or in the vicinity of the HGLA. In 2016, when geothermal plant construction is scheduled to begin, competition for relevant construction skills could arise if other heavy construction projects of significant size are in progress. If the local work force is fully utilized, construction managers for on-site projects, as well as for other projects in the region, would have to attract workers from outside the area. In this way, the demand for transient housing and public services might increase, along with a potential long-term population increase.

Additional Renewable Energy Projects

During the next several years, it is expected that wind and solar generation projects, and their associated transmission lines, would be needed to serve Southern California markets. The number and size of such projects indicates considerable interest in the region's value as a location for renewable electricity generation and distribution. Though there are no construction schedules for such wind and solar projects, their construction activities would likely occur beyond 2015 and possibly coincide with the RFD's 2016-2020 development period.

Another significant potential for energy development would be continuing solar energy generation and distribution from the Tehachapi Wind Resource Area (TWRA). The TWRA currently consists of about 3,400 wind turbines producing about 710 MW of power. There is interest in increasing TWRA's generating capacity and at the nearby Alta development,

which could add 700-900 MW of capacity. No applications have been filed for additional wind projects, and there is no specific information to conduct a full environmental evaluation (Kern County 2009). Implementing these projects would greatly increase Inyo and Kern counties' populations, demands for housing and public services, personal incomes, and tax revenues. Individual or cumulative employment estimates for these projects are not available.

Concerning the four projects that the CEC is reviewing, from 2011-2013, their average daily employment is expected to be 2,272. Should the four projects and all of the other proposed projects named above be constructed, their direct and indirect impacts would be substantial and spread throughout northern Los Angeles, Kern, and northwest San Bernardino counties. Though it is unlikely that all of the proposed/potential renewable energy projects in the region would be constructed, it is reasonable to assume that some would be constructed. In this way, the region might rebound from employment losses that it suffered during the 2007-2009 recession. However, it is important to note that renewable energy project development is speculative and long-term operation would require small work forces.

Non-Energy-Related Construction Projects

In addition to projects proposed in the HGLA's vicinity, other construction projects were assessed based on their potential to impact housing and public services that are not available in the HGLA's vicinity. Numerous residential, commercial, and small industrial projects have been identified in reports citing development applications in the cities of the SSA. These projects are considered part of "normal," baseline development, rather than major projects that would change the population and employment projections for the region.

Projects of interest to this cumulative impacts analysis would be those with significant construction activity planned when geothermal plant construction and well drilling on-site would be occurring from 2016 to 2020. Because of the long lead time needed for exploration and environmental permitting before construction could begin on-site, most construction projects specifically identifiable for the region would already be completed before the critical 2016-2020 time period. Projects that could have significant construction labor demands, and associated population, housing, and public services/finances impacts, are in early planning stages. Reliable estimates of their construction employment demands, or actual schedules, are unknown.

During 2016-2020, the California High Speed Rail Project is the only major project with information that can be used to evaluate cumulative impacts. The project's 60-minute commuting radius for construction workers would overlap the SSA. This project would link the San Francisco Area and the Los Angeles/San Diego area with high-speed rail. The rail line would pass through Bakersfield in Kern County and Palmdale in Los Angeles County. From 2013 to 2017, proponents would construct the Bakersfield-Palmdale and Palmdale-Los

Angeles links. During this time period, the project is expected to employ approximately 160,000 construction workers. Peak construction would occur in 2015. The rail line would be commissioned in 2018.

No annual work force estimates have been published for the Kern County portion of the project alone. However, based on construction cost estimates published by the California High-Speed Rail Authority (CHSR 2009) for the two links passing through Kern County, the annual construction work force could be approximately 3,000 workers in 2013-2017, with peak-year employment of approximately 4,000. The size of this construction project could have significant impacts on the demand for Kern County construction workers, as well as on Kern County's population, particularly in the SSA's southern portion.

As mentioned above, the RFD scenario's impacts are expected to be minimal. However, if considered along with the other potential energy projects and the California High Speed Rail Project, there would likely be a need for temporary workers beyond those that are locally available. This may cumulatively result in significant, temporary impacts on local populations, housing, and public services; and temporary cumulative impacts to the region.

4.21 IRREVERSIBLE OR IRRETRIEVABLE COMMITMENT OF RESOURCES

NEPA requires an analysis of significant irreversible or irretrievable commitment of resources. Resources irreversibly or irretrievably committed are those utilized on a long-term or permanent basis, or consumed through implementation of the action.

Any decision to amend the CDCA Plan (or not) would not result in an irreversible or irretrievable commitment of resources because the plan amendment does not authorize the development of any geothermal resources or any specific geothermal project. It is possible that the HGLA RFD will not be implemented, even if the CDCA Plan is amended to allow for geothermal development within the HGLA. Neither would issuance of the three pending lease applications result in an irreversible or irretrievable commitment of resources, as the applicants would not be allowed to develop the resource without further approval of the BLM undertaken in compliance with applicable Federal laws, including NEPA. Any irreversible or irretrievable commitment of resources within the HGLA will not occur unless and until the BLM authorizes the development of specific geothermal resources at a later time through a separate decision.

4.22 SHORT-TERM USE VERSUS LONG-TERM PRODUCTIVITY OF THE ENVIRONMENT

The relationship between the anticipated short-term use of environmental, land use, and socioeconomic resources, and the maintenance and enhancement of long-term productivity, typically considers short-term construction impacts versus the long-term benefits of the project. If geothermal leases are issued, short-term impacts are typically associated with the exploration, construction, and maintenance phases, and include activities such as access road construction, increased traffic volumes and human disturbance, well construction and development, and construction and testing of the geothermal power plant facilities and associated infrastructure. Long-term impacts are typically associated with operation of these facilities during their projected life. These impacts were found to include the long-term loss of vegetation and displacement of wildlife from developed areas; minor adverse air quality impacts from plant facilities and vehicles; negligible noise impacts from plant facilities such as cooling towers and steam vents; visual impacts; generation of wastes; and possible conflicts with recreational use, livestock grazing, mineral extraction, and access to public lands.

The extent of both short- and long-term impacts will be dependent, to a large degree, on the site-specific conditions at future geothermal development sites. Future NEPA studies and permitting efforts will identify the suitability of candidate locations. Potentially adverse impacts will be mitigated, to the greatest degree feasible, by the various BMPs, stipulations, and lease terms described in Chapter 2. Moreover, the generation of jobs and other economic benefits, along with the generation of clean, renewable energy production, will clearly provide long-term benefits to Inyo County and surrounding areas under this program. As stated in BLM's Programmatic Environmental Impact Statement for Geothermal Leasing in the Western United States (BLM, 2008):

“Over the long-term, while geothermal plants are in production, these new plants would be producing a low-cost, clean source of renewable energy for use in the project area and other western states. While in production, each plant would provide employment opportunities for citizens of surrounding communities. The sale of this new energy would be a new source of revenue for the counties within which the projects are located. In addition, geothermal energy development offsets the use of irretrievable resources such as coal and oil, which would result in less pollution, fewer greenhouse gas emissions, less dependence on foreign oil and gas, and a possible reduction in the trade deficit.”

4.23 RESIDUAL IMPACTS

Under the BLM's three action alternatives opening the HGLA to geothermal leasing and amending the CDCA Plan to reflect that decision, any future geothermal exploration, development, and utilization in the HGLA would result in a number of short- and long-term residual impacts as discussed throughout previous sections of Chapter 4. Residual impacts are those impacts that would remain after mitigation measures have been applied. If geothermal leases were developed and issued following thorough NEPA analyses, evaluation of alternatives, and meeting the appropriate permitting requirements, the following general residual impacts could be expected under BLM's Haiwee RFD scenario:

- Long-term loss of vegetation, wildlife habitat, and soils within 276 acres of HGLA lands and in the short-term construction footprint, in the absence of vegetation restoration;
- Short-term and intermittent noise impacts from exploration, construction, and maintenance activities. Noise impacts during the subsequent operation of the geothermal power plants should be minimal, although somewhat dependent on cooling tower technology;
- Possible loss of some recreational opportunities due to access restrictions into developed areas;
- Long-term visual impacts from the geothermal power plants and associated facilities like roads and transmission lines;
- Potentially short-term and local impacts to groundwater;
- Short-term and local impacts to traffic volumes and the transportation network during construction;
- Short-term seasonal impacts to housing during the peak of construction.

4.24 PLAN CONFORMANCE

The land use plan amendment decision to be made by the BLM is a site identification decision only. The HGLA is located within land that is managed as Multiple Use Class L. The classification designations govern the type and degree of land-use action allowed within the classification area. Land use actions and resource-management activities on public lands

within a multiple-use class delineation should meet the guidelines for that class. Multiple use class L allows the development of geothermal power plants under the electric generation facilities subpart pursuant to licenses being issued under 43 CFR Section 3250, et. seq. This allowance also requires an EIS. These guidelines are listed on Table 1, Multiple Use Class Guidelines, to the CDCA Plan of 1980 (at page 15). The specific application of the multiple use class designations and resource management guidelines for a specific resource or activity are further discussed in the plan elements section of the CDCA Plan. Class L lands are managed to provide for generally lower-intensity, carefully controlled multiple use of resources, while ensuring that the sensitive values are not significantly diminished. Approximately fifty percent of the California Desert Conservation Area is managed as Class L land.

The HGLA site location for the project meets the Multiple Use Class Guidelines (as applicable to the particular project/alternatives/site locations) as noted in the CDCA Plan for the following reasons:

1. Agriculture:

Agricultural uses, excluding livestock grazing, are not allowed on Class L lands. The site is not currently used for agriculture, and none of the project alternatives would involve use of the site for agriculture. Therefore, all five alternatives would be in conformance with this guideline.

2. Air Quality:

Class L lands, including the proposed site location and the alternatives, are to be managed to protect their air quality and visibility in accordance with Class II objectives of the Federal Clean Air Act Amendments, unless otherwise designated another class by the State of California as a result of recommendations developed by any BLM air quality management plan. These Class II objectives include, among others, attainment and maintenance of the ambient air quality standards and protection of visibility within the CDCA. The air emissions that would be associated with the proposed project are discussed in Section 4.2. These values have been compared to emissions objectives for air quality and visibility associated with Class II areas, and are all well below the limitations required for Class II areas. The emissions associated with Alternatives A, C and D would be similar, and there would be no emissions associated with Alternatives B and E. Therefore, all of the alternatives would conform to the Class II objectives referenced in the CDCA Plan guidelines.

3. Water Quality:

Class L land will be managed to minimize the degradation of the water resources. Best management practices, developed by the BLM during the planning process outlined in the Clean Water Act, Section 208, et seq., will be used to avoid degradation and to comply with Executive Order 12088. Section 4.6 of this EIS evaluated the Alternatives for groundwater use conflicts, the potential to impact groundwater quantity and quality, and the potential to impact surface water resources. As analyzed in Chapter 4.6, Alternatives A, C and D, could utilize groundwater but would not result in degradation due to the requirements built in to the alternatives. Without the exact siting of a geothermal project, it is difficult to project exact impacts to surface water. However, with the conditions built into the action alternatives, there would be no degradation of the surface water. Alternatives B and E would not impact groundwater or surface water. BLM's standard terms and conditions requiring compliance with other Federal, state, and local regulations would result in compliance with Executive Order 12088. The measures would be applicable to all project alternatives, and would therefore conform to the guidelines in Table 1 of the CDCA Plan.

4. Cultural and Paleontological Resources:

Archaeological and paleontological values will be preserved and protected. Procedures described in 36 CFR 800 will be observed where applicable. Sections 4.8 and 4.9 describe the impacts on cultural and paleontological resources associated with the project. All five alternatives would conform to the guidelines. All of the alternatives are within the MUC Guidelines for cultural and paleontological resource protection established by the CDCA Plan.

5. Electrical Generation Facilities:

Geothermal generation may be allowed pursuant to licenses issued under 43 C.F.R. Section 3250, et. seq. and after NEPA requirements are met. The analysis contained in the EIS, comprise the NEPA compliance required for this MUC guideline. All action alternatives would require licenses consistent with 43 C.F.R. 3250, et. seq. All alternatives are in conformance with the CDCA Plan for generation facilities.

6. Transmission Facilities:

Class L guidelines allow electric transmission to occur in designated ROW corridors. The HGLA is partially located in a corridor. A transmission line for each power generation facility is part of the three action alternatives. If this transmission line is of 161 kV or above and is outside of the designated corridor a Plan Amendment would be required. If the transmission lines are within the designated corridor, all the action alternatives are in conformance with the CDCA Plan requirements for Class L

transmission facilities. Alternatives B and E are in conformance with the CDCA Plan since they do not include any new transmission lines.

7. Communication Sites:

None of the alternatives would require the installation of communications sites.

8. Fire Management:

Fire suppression measures in Class L areas will be taken in accordance with specific fire management plans, subject to such conditions as the authorized officer deems necessary. The project area is within the area covered by the California Desert District Fire Management Plan, March 2010. That Plan addresses management and suppression of wildfires, and does not address incidents on specific facilities such as power plants. Should a fire occur in the area that is not specific to the facility, it would be addressed by BLM, not by the applicant, and it would be addressed in conformance with the Fire Management Plan.

9. Vegetation:

Table 1 of the CDCA Plan includes a variety of guidelines associated with vegetation. These are addressed in the EIS as follows:

Native Plants

Removal of native plants in Class L areas is only allowed by permit after NEPA requirements are met, and after development of necessary stipulations. Approval of the ROW grant for the any of the action alternatives would constitute the permit for such removal. The mitigation measures in the EIS and conditions of approval to be required in the Record of Decision would constitute the stipulations to avoid or minimize impacts from the removal.

Harvesting of plants by mechanical means

Harvesting by mechanical means is also allowed by permit only. The guidelines for vegetation harvesting include encouragement of such harvesting in areas where the vegetation would be destroyed by other actions, which would be the case with the action alternatives. Therefore, the proposed project and its alternatives would be in conformance with this MUC guideline.

Rare, Threatened, and Endangered Species, State and Federal

In all MUC areas, all state and federally listed species will be fully protected. In addition, actions which may jeopardize the continued existence of federally listed species will require consultation with the U.S. Fish and Wildlife Service. This is fully evaluated in Section 4.7.

Sensitive Plant Species

Identified sensitive plant species would be given protection in management decisions consistent with BLM's policy for sensitive species management, BLM Manual 6840. The objective of this policy is to conserve and/or recover listed species, and to initiate conservation measures to reduce or eliminate threats to BLM sensitive species to minimize the likelihood of and need for listing. Further information on sensitive plant species may be found in Section 4.7, including mitigation measures to reduce the potential impact of the action alternatives. Because these measures are intended to reduce threats to this species to minimize the likelihood of listing, these measures are in conformance with the MUC guidance in the CDCA Plan.

Unusual Plant Assemblages (UPAs)

No UPAs have been identified on the site of the proposed HGLA.

Vegetation Manipulation

Manipulation of vegetation in Class L areas by mechanical control or aerial broadcasting is not permitted. Vegetation manipulation is defined in the CDCA Plan as removing noxious or poisonous plants from rangelands; increasing forage production; creating open areas within dense brush communities to favor certain wildlife species; or eliminating introduced plant species. None of these actions would be conducted as part of the action alternatives. Noxious weed eradication is allowed after site-specific planning. Types and uses of pesticides, in particular herbicides, must conform to Federal, States and local regulations. The action alternatives would require the applicant follow required regulations. Therefore, each alternative would conform to the guidelines.

10. Land Tenure Adjustment:

The CDCA Plan states that Class L land would not be sold. None of the alternatives would involve the change of ownership of land.

11. Livestock Grazing:

Class L lands are managed to allow grazing and support facilities with the protection of sensitive resources. Manipulation of vegetation by chemical or mechanical means is not allowed except for site-specific needs. No alternatives involve the addition of livestock or livestock support facilities. However, depending upon the potential future siting of a geothermal facility, the animal management units in an existing grazing allotment may be reduced. No alternative involves changing the allowance of grazing, installation of support facilities or the manipulation of vegetation. All alternatives are in conformance with the plan.

12. Minerals:

No alternatives involve the development of non-fluid minerals on Class L lands.

13. Motorized Vehicle Access/Transportation:

Pursuant to the CDCA LUP guidelines in Class L areas, new roads may be developed under ROW grants or pursuant to regulations or approved plans of operations. In areas designated as limited use area for OHV use, such as the site locations under consideration in this FEIS, changes to the transportation network (new routes, re-routes, or closures) in “limited” areas may be made through activity-level planning or with site-specific NEPA analysis (IM 2008-014). Some roads would be developed if Alternatives A, C or D are selected. The specific roads would require a later site-specific NEPA analysis. The access needs for the two geothermal facilities do not substantially differ among the various alternatives presented in the EIS. The alternatives are compliant with the CDCA LUP guideline.

14. Recreation:

The action alternative would not involve the use of the proposed project for recreational uses.

15. Waste Disposal:

No alternatives would involve the development of waste disposal sites.

16. Wildlife Species and Habitat:

Table 1 of the CDCA Plan includes a variety of guidelines associated with wildlife. These are addressed in the EIS as follows:

Rare, Threatened, and Endangered Species, State and Federal

In all MUC areas, all state and federally listed species and their critical habitat will be fully protected. In addition, actions which may jeopardize the continued existence of federally listed species will require consultation with the U.S. Fish and Wildlife Service. As discussed in Section 4.7, the desert tortoise, which is listed as federally and state threatened, would be affected by the action alternatives. However, the action alternatives would cause only minor affects to critical habitat. The BLM has initiated formal consultation with the U.S. Fish and Wildlife Service in accordance with Section 7 of the Endangered Species Act. Section 4.7 identifies protection and compensation measures for the desert tortoise, which include stringent avoidance measures, the full level of compensation required by USFWS for this category of tortoise habitat, and enhancement and protection measures in other areas. Therefore, the proposed project and its alternatives would comply with the guideline to provide full protection to the species.

Sensitive Species

Identified species would be given protection in management decisions consistent with BLM's policy for sensitive species management, BLM Manual 6840. The objective of this policy is to conserve and/or recover listed species, and to initiate conservation measures to reduce or eliminate threats to BLM sensitive species to minimize the likelihood of and need for listing. BLM sensitive wildlife species are discussed in Section 3.7 and the effects of the Alternatives is analyzed in Section 4.7.

The action alternatives including the mitigation measures associated with these actions, could involve habitat manipulation to improve habitat (such as restoration work). Habitat manipulation to improve wildlife habitat is allowed in Class L subject to environmental assessment, which will be completed separately. Therefore, the alternatives would be in conformance with these guidelines.

Although allowed by the CDCA Plan, the action alternatives do not involve the introduction or reintroduction of any species, so all alternatives are in conformance with this part of the plan.

17. Wetland/Riparian Areas:

Wetland/riparian areas will be considered in all proposed land use actions. These issues were considered in the analysis of the HGLA for the all alternatives. All alternatives are in compliance with this part of the Plan.

18. Wild Horses and Burros:

Under the CDCA Plan guidelines, populations of wild and free-roaming horses and burros will be maintained in healthy, stable herds, but will be subject to controls to protect sensitive resources. No alternative changes this Plan element.

19. Corridor Analysis:

The HGLA contains two utility corridors. Depending on the actual location of a geothermal facility, which would be determined in a future NEPA decision, the development could impact the use of the corridor for future transmission needs. There appears to be adequate capacity within the corridors for some use of the corridors for geothermal development. In the actual siting of a facility, it will be important to conduct a detailed corridor analysis to determine the impact to the corridor for the specific project. All alternative should allow the continued function of the corridor to meet future needs.

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CHAPTER 5

CONSULTATION

COORDINATION

AND

PUBLIC PARTICIPATION

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CHAPTER 5 CONSULTATION, COORDINATION AND PUBLIC PARTICIPATION

5.1 INTRODUCTION

Federal agencies preparing an Environmental Impact Statement (EIS) must “make diligent efforts to involve the public in preparing and implementing their National Environmental Policy Act (NEPA) procedures” (40 CFR 1506.6 (a)). Early and continuing coordination with the public and agencies are an essential part of the environmental review process to determine the scope of environmental documentation, the level of analysis, potential impacts and mitigation measures, and related environmental requirements. Council of Environmental Quality (CEQ) regulations provide guidance on the scoping process, including inviting participation of affected federal, state, and local agencies, Indian Tribes, as well as any other interested parties (40 CFR 15017.7 (a)(1)).

Consistent with the NEPA procedures, public participation and agency consultation have been accomplished through issuance of public notices, public scoping meetings, and correspondence with agencies and Native American Tribes. This chapter summarizes the results of the Bureau of Land Management’s (BLM) public involvement efforts to fully identify, address, and resolve program-related issues through early and continuing coordination.

5.2 SCOPING

Scoping is an “early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action” (40 CFR 1501.7). The public, affected agencies, Native American Tribes, and other interested parties are invited to participate in the environmental review process. In addition to the purpose of informing the public about the HGLA, the scoping process is also meant to achieve the following: (1) identify potentially significant environmental impacts for consideration in the EIS; (2) identify possible mitigation measures; (3) identify alternatives to the proposal; and (4) compile a notification list of public agencies and individuals interested in future meetings and notices.

5.2.1 Public Scoping Meeting

The BLM conducted four public scoping meetings between October 13 and October 20, 2009, in Lone Pine, Bishop, Ridgecrest and Death Valley, California. These meetings were

attended by a total of 32 attendees. Table 5.2-1 lists the dates, and locations for each of the meetings. The scoping meetings provided an opportunity for the BLM to: (1) share information regarding the HGLA; (2) discuss the proposed CDCA Plan Amendment, the decision-making processes regarding amending a plan, and consideration of whether to grant or deny pending geothermal leases; and (3) listen to the public, agency, and Native American views on the range of issues and alternatives to be considered during the preparation of the EIS and proposed CDCA Plan Amendment.

Table 5.2-1 Scoping Dates and Locations

Date	Location
Tuesday, October 13, 2009 5:30 – 9:00 p.m.	Boulder Creek RV Resort 2550 S. Hwy 395 Lone Pine, CA
Wednesday, October 14, 2009 5:30 - 9:30 p.m.	Eastern Sierra Fairgrounds Home Economics Bldg. Sierra Street & Fair Drive Bishop, CA
Thursday, October 15, 2009 5:30 - 9 p.m.	Kerr-McGee Center 100 W. California Ave Ridgecrest, CA
Tuesday, October 20, 2009 10:00 a.m. to 1:30 p.m.	Timbisha Shoshone Tribal Office 900 Indian Village Rd Death Valley, CA

5.3 CONSULTATION AND COORDINATION

This section describes the consultation and coordination efforts conducted by the BLM with the public, agencies, and elected officials in the preparation of this Draft EIS, the proposed CDCA Plan Amendment, and decision-making regarding issuance of any of the pending lease applications. To engage the public and agencies in the NEPA process, the BLM published a Notice of Intent, distributed two press releases, held field tours, provided briefings, and responded to all communication opportunities.

5.3.1 Notice of Intent

To comply with 40 CFR 1508.22, on September 11, 2009, the BLM published a Notice of Intent (NOI) in the *Federal Register*, Volume 74, Number 175. Entitled “*Notice of Intent To Prepare an Environmental Impact Statement for the Proposed Leasing of National System of Public Lands for Geothermal Resource Development in the Haiwee Geothermal Leasing Area Located in Inyo County, CA and To Amend the California Desert Conservation Area Plan of 1980*”, the NOI described the BLM Ridgecrest Field Office’s intent to prepare an EIS to analyze the proposed leasing of 22,460 acres of BLM-managed public lands for geothermal exploration, development, and utilization in the Haiwee Geothermal Leasing Area (HGLA).

The September 11, 2009, NOI also served to announce that the leasing of public lands will require an amendment to the California Desert Conservation Area (CDCA) Plan of 1980, as amended. As such, the BLM also complied with the requirements of 43 CFR 1610.2(c) requiring notification of the public on potential amendments to land use plans.

The NOI initiated the public scoping period for the Haiwee EIS and proposed CDCA Plan Amendment. The NOI provided the background and need for the proposed action, and described the locations of public lands being considered for geothermal leasing in the HGLA. It discussed the alternatives identified for evaluation in the EIS, aspects of the environmental review process, as well as the preliminary issues to be addressed in the EIS. The NOI provided the BLM contact information, and served as an invitation for other federal agencies to provide comments on the scope and content of the EIS/Plan Amendment, and requested that all comments be received by October 13, 2009.

5.3.2 News Releases

On September 11, 2009, the BLM issued a news release announcing the times and locations of the public scoping meetings in Lone Pine, Bishop and Ridgecrest, California. The news release also listed issues to be analyzed in the EIS, and contact information. A second news release was issued on October 10, 2009, announcing the addition of the Death Valley scoping meeting date, time, and location.

On July 28, 2011, the BLM issued a news release announcing that decisions will be made regarding the authorization or denial of the three pending lease applications. This analysis and decision making process is consistent with the presentation at each of the Scoping Meetings.

5.3.3 Agencies

Federal, state, and local agencies were invited to participate in the HGLA scoping meetings via two news releases issued by the BLM. The news releases also identified preliminary issues and concerns for the project, as well as contact information. Follow up emails, letters, and telephone calls were made to the agencies to solicit issues and concerns, and coordinate with permitting agencies.

5.3.4 Elected Officials

Inyo County Supervisors were sent scoping letters inviting them to participate in the scoping process for the BLM's preparation of an EIS and proposed CDCA Plan amendment for geothermal exploration, development, and utilization in the HGLA. The letters also described the proposed action, NEPA process, scoping, preliminary resource management issues and concerns, and schedule. A representative copy of the letter may be found in Appendix H, and Table 5.3-1 lists the recipients and their districts.

Table 5.3-1 Inyo County Supervisors and Representative Districts

Inyo County Board of Supervisors	Representative District
Linda Arcularius	District 1
Susan Cash	District 2
Beverly Brown (now Rick Pucci)	District 3
Marty Fortney	District 4
Richard Cervantes	District 5

5.3.5 Naval Air Weapons Station, China Lake

On September 24, 2010, the BLM conducted a briefing with the Naval Air Weapons Station (NAWS), China Lake. The BLM took this opportunity to inform NAWS about the HGLA; to go over the purpose and need for geothermal leasing on BLM-managed lands; to review the alternatives; as well as to solicit comments.

5.3.6 California Office of Historic Preservation

The BLM Ridgecrest office consulted with the California Office of Historic Preservation in Sacramento in regard to the nature of the project and Section 106 compliance.

On May 23, 2011, the BLM Project Manager and the Ridgecrest Field Office Manager met with members of the State Historical Preservation Office (SHPO) in a teleconference. This meeting provided SHPO a general briefing and overview of the project.

On August 31, 2011 and September 1, 2011, the BLM Project Manager and Ridgecrest Field Office staff met with members of the SHPO and provided an in-depth project review and site tour.

5.3.7 Government-to-Government Consultation with Indian Tribes

5.3.7.1 Laws, Regulations, and Policies

There are numerous federal laws, regulations, and policies directing agencies to consult with federally recognized Indian tribes in a government-to-government manner. Information and guidelines can be found in BLM Handbook H-8120-1.

National Environmental Policy Act (NEPA) Implementing Regulations 40 CFR Part 1500

NEPA requires the preparation of an environmental assessment (EA) or environmental impact statement (EIS) for any proposed major federal action that may significantly affect the quality of the human environment. While the statutory language of NEPA does not mention Indian tribes, the Council on Environmental Quality (CEQ) regulations and guidance do require agencies to contact Indian tribes and provide them with opportunities to participate at various stages in the preparation of an EA or EIS. CEQ has issued a Memorandum for Tribal Leaders encouraging tribes to participate as cooperating agencies with federal agencies in NEPA reviews. Section 40 CFR 1501.2(d)(2) requires that Federal agencies consult with Indian tribes early in the NEPA process. Other sections also refer to interacting with Indian tribes while implementing the NEPA process.

National Historic Preservation Act (NHPA), as amended (16 USC 470f)

The principal federal law in the United States protecting historic properties. Historic properties are those properties that are eligible for, or listed on the National Register of Historic Places. In carrying out its responsibilities under Section 106 of this Act, a federal agency shall consult with any Indian tribe that attaches religious and cultural significance to historic properties. Section 304 of the NHPA also provides for maintaining the confidentiality of information concerning the nature and location of historic properties to protect resources in specific circumstances. The ACHP has promulgated regulations implementing section 106 of the NHPA at 36 CFR Part 800.

The Archeological Resources Protection Act of 1979. (ARPA) (16 U.S.C. 470aa-mm)

Directs federal agencies to consult with tribal authorities before permitting archeological excavations on tribal lands (16 U.S.C. 470cc(c)). Consultation is specifically required where

issuance of a permit for the excavation of an archaeological resource poses a threat to sites of religious or cultural importance. It also provides for the confidentiality of information concerning the nature and location of archeological resources, including tribal archeological resources.

NAGPRA (25 U.S.C. 3001, et. seq.)

Requires consultation with Indian tribes, traditional religious leaders and lineal descendants of Native Americans regarding the treatment and disposition of specific kinds of human remains, funerary objects, sacred objects and other items.

American Indian Religious Freedom Act of 1978 (AIRFA) (Title 42, U.S. Code, Section 1996)

Establishes policy of respect and protection of Native American religious practices. It seeks to correct federal policies and practices that could (a) deny access to sacred sites required in traditional religions, (b) prohibit use and possession of sacred objects necessary for religious ceremonies, and (c) intrude upon or interfere with religious ceremonies. The BLM complies with AIRFA by obtaining and considering the views of traditional religious practitioners as part of the NEPA compliance process.

Executive Memorandum of April 29, 1994 (Presidential Memorandum for the Heads of Executive Departments and Agencies Regarding Government-to-Government Relations with Native American Tribal Governments)

Directs each federal agency to operate within a government-to-government relationship with federally recognized tribal governments; consult with tribal governments; assess the impact of plans, projects, programs, and activities on tribal trust resources; and assure that tribal rights are taken into account during consideration of such plans, projects and activities.

Executive Order. 13175 (Consultation and Coordination with Indian Tribal Governments), issued November 6, 2000

Directs federal agencies to establish regular and meaningful consultation and collaboration with Tribal officials in the development of federal policies that have Tribal implications, to strengthen the United States government-to-government relationships with Indian tribes as described in the Executive Memorandum of April 29, 1994, and to reduce the imposition of unfunded mandates upon Indian tribes.

Executive Order 13007

Directs federal agencies to accommodate access to, and ceremonial use of, Indian sacred sites by Indian religious practitioners. It requires federal agencies to avoid adversely affecting the physical integrity of sacred sites to the extent practicable, permitted by law, and not clearly inconsistent with essential agency functions. EO 13007 reinforces the purposes expressed in

AIRFA. The BLM complies with EO 13007 by consulting with tribal governments and Indian religious practitioners as part of the NEPA compliance process.

DOI Consultation Policy

In December 2011, the Department of the Interior issued the *Policy on Consultation with Indian Tribes*. This policy clarifies and provides guidance into the application of various laws and regulations that pertain to tribal consultation. BLM guidance for tribal consultation is also provided in *Manual 8120 Tribal Consultation under Cultural Resource Authorities* (2004) (http://www.blm.gov/style/medialib/blm/wo/Information_Resources_Management/policy/blm_manual.Par.80216.File.dat/8120.pdf); and in *Handbook H-8120-1 Guidelines for Conducting Tribal Consultation*. (2004) (http://www.blm.gov/style/medialib/blm/wo/Information_Resources_Management/policy/blm_handbook.Par.86923.File.dat/h8120-1.pdf).

The Native American Element of the CDCA Plan identifies three goals related to Native American concerns:

- Identify Native American values through regular contact and consultation with tribal entities and/or individuals, consistent with policy.
- Give full consideration to Native American values in land-use planning and management decisions, consistent with statute, regulation and policy.
- Manage and protect Native American values wherever prudent and feasible.

5.3.7.2 Summary of Government-to-Government Tribal Consultation

The BLM has coordinated the NEPA commenting process to partially satisfy the public involvement process for Section 106 of the NHPA (16 U.S.C. 470f) as provided for in 36 CFR 800.2(d)(3). Consultation with Indian tribes has been conducted and tribal concerns have been given due consideration, including impacts on Indian trust assets (there are no Indian trust assets within the CDCA). Federal, state, and local agencies, along with tribes and other stakeholders that were interested or affected by the BLM's decision on this project, were invited to participate in the scoping process and, if eligible, could request or be requested by the BLM to participate as a cooperating agency pursuant to NEPA, and/or a consulting party pursuant to NHPA.

The BLM has initiated government-to-government consultation with the Big Pine Paiute Tribe, the Bishop Paiute Tribe, the Fort Independence Paiute Tribe, the Lone Pine Paiute-Shoshone Tribe, and the Timbisha Shoshone Tribe as part of the scoping process for the HGLA EIS. None of those Indian tribes have treaties with the United States Government,

and no trust assets managed by the BLM are within the HGLA. On October 7, 2009, the BLM sent letters via certified mail to the five aforementioned Indian tribes, inviting them to participate in the scoping and consultation process. Appendix F contains a representative letter to the Tribes. The letter discussed the HGLA, its location, NEPA and NHPA process, scoping locations, and contact information.

Native American Tribes participating in the Scoping Process requested an opportunity for additional involvement, particularly through the Section 106 consultation process (see Section 5.3.8). They are concerned about extraction of resources from the land; the benefit to the Tribes from the proposed action; impacts on spiritually important sites; impacts to Coso Hot Springs; the effects of the proposed action on the water table; the need for new transmission lines; and whether the new facilities could prohibit access to traditional lands. They also stated that geothermal development in the leasing area could conflict with their traditional values and that impacts on Native American values are not amenable to mitigation. Also expressed was the desire to have tribal monitors present in the event of any surface disturbing activities.

The BLM has received responses from two Indian tribes – the Big Pine Paiute Tribe on November 20, 2009 and the Bishop Paiute Tribe on January 21, 2010. Comments and recommendations in the November 20, 2009 response letter from the Big Pine Paiute Tribe included:

- Need for timely tribal notification of projects by the BLM;
- Relationship of the HGLA to the Coso Known Geothermal Resource Area;
- Long-term viability of geothermal energy;
- Denial of access to the land in the leasing area;
- Overuse of water to the extent that plant and animal species and habitats would be harmed; and
- The need for the EIS to address impacts to wetlands, regional hydrology, vegetation, wildlife, rare plant and animal species, geology, aesthetics and scenic values, recreation, dust generation, as well as cumulative impacts.

Comments and recommendations in the January 21, 2010, response letter from the Bishop Paiute Tribe included:

- Information on the project boundaries and design;
- Results of cultural resource records searches and cultural resource surveys;
- The need for a visit to the HGLA area;
- Recommended that qualified archaeologists perform future surveys prior to any development;
- Recommended that cultural resource monitors be used during surveys and ground disturbance; and
- Copies of all cultural resource documentation.

Comments received from the Tribes are discussed in Section 5.4. Government-to-government consultation for this EIS is ongoing. The BLM will continue to consult with interested tribes and will continue to keep all tribal entities informed about the NEPA process for this EIS.

At a meeting on July 19, 2011, the BLM Project Manager and Acting Field Office Manager briefed the Tribal Council of the Big Pine Paiute on the pending Draft EIS.

On July 21, 2011, the BLM Project Manager provided a field briefing and site tour to the Vice-Chairman of the Timbisha Shoshone, a member of the Big Pine Paiute Tribal Council, and two members of the Kern Indian Community.

On August 16, 2011, the BLM Project Manager provided a second field briefing and site tour to representatives of the Lone Pine Paiute-Shoshone Tribe, including the Tribal Historic Preservation Officer and the Tribal Environmental Coordinator. Also in attendance were representatives of the Bishop Paiute Tribe, including the Tribal Environmental Coordinator, the Tribal Historic Preservation Officer, and a Tribal Cultural Committee Member.

In the discussions noted above, no specific TCPs, archaeological sites, locations of important historic events, sacred sites, sources of raw material used to make tools or sacred objects, or traditional hunting and gathering areas have been identified within the HGLA. In contrast, the idea that the entire landscape is sacred, was expressed. Additionally, no specific sites have been identified as eligible for listing in the NRHP.

5.4 SUMMARY OF COMMENTS RECEIVED

During the scoping process, the BLM received 14 comment letters and numerous verbal comments during the scoping meetings. Below is a summary of the issues and concerns that were used to determine the scope and significant issues to be analyzed in the Draft EIS. A detailed summary of the public scoping effort, and document issues and concerns expressed during scoping may be found in the Scoping Report (see Appendix H).

5.4.1 Purpose and Need

A number of commenters were concerned about the impacts of potential geothermal exploration, development, and utilization. They requested identification of suitable and non-suitable locations for geothermal resources. The public inquired about the anticipated amount of generation, the power plant type and lifespan, and cooling methods. Many commenters requested that the quantity of water needed, and its source, be identified.

A discussion of the Plan Amendment to the CDCA Plan in regards to the Geothermal Programmatic EIS and HGLA was requested. Some scoping meeting attendees were interested in the relationship of the HGLA to the Deep Rose Geothermal Exploration Project and the three pending lease applications, as well as the connection to Coso Geothermal Fields.

5.4.2 Alternatives

It was recommended that a reasonable range of alternatives, including the no action alternative, be analyzed. The following alternatives were suggested by the public and agencies: smaller leasing areas, alternative geothermal facility designs, and alternative water sources. There was also concern regarding the lack of a competitive bidding process for leasing of government lands for other renewable energy development, such as solar and wind, and multiple uses of the land.

5.4.3 Air Quality

Consideration of potential impacts caused by windborne dust and pollution, carbon dioxide emissions, and impacts to air quality in Rose Valley was recommended. It was also suggested that any program-related emission contributions to non-attainment areas be addressed, and that greenhouse gases and global warming be addressed.

5.4.4 Biological Resources

Concern was expressed for the potential loss of water resources in Rose Valley, and for the potential impacts it may cause to habitat and vegetation. A member of the public requested a surface water baseline study to analyze the potential impacts of surface water withdrawal to the local ecosystem. Analysis of riparian habitats, sensitive natural communities, natural springs, and artesian wells throughout the Rose Valley was also suggested.

Concern was also expressed over the loss of habitat for the Mojave ground squirrel and Desert Tortoise. The Naval Air Weapons Station (NAWS), China Lake expressed concern about the West Mojave (WEMO) Plan's compensation ratios for the Mojave ground squirrel. They were also concerned with the potential to exceed the disturbance threshold. A member of the public also requested that impacts to vegetation, animals, and insects be addressed. Coordination with the California Department of Fish and Game was requested.

5.4.5 Geothermal Resources

An organization requested the identification of the size and composition of existing geothermal resources. It was requested that the amount of electrical production from geothermal resources be based upon the size and extent of the reservoir. It was also requested that preservation of the geothermal reservoirs and long-term management be addressed. Attendees were concerned about the seismic activity in the area, and depletion of underground water basins. There was concern regarding potential impacts to the Coso Geothermal Power Plant and operations, as well as to the Coso Hot Springs. Attendees were interested in the cumulative impacts of a number of geothermal projects (existing and future) in close proximity to the HGLA.

5.4.6 Hazards and Hazardous Materials

There was concern regarding the potential for hazardous substance generation by future development in the HGLA, and treatment and disposal of hazardous substances. An analysis of wastewater and emission hazards to the public, and potential impacts from heat emissions, was requested.

5.4.7 Land Use / Agriculture / Recreation

Some scoping meeting attendees are concerned about the relationship of a number of desert management plans such as the CDCA Plan, the Northern and Eastern Mojave (NEMO) Plan, and the West Mojave (WEMO) Plan with the proposed activities in the HGLA, and with potential land use conflicts. The HGLA contains roads utilized by recreational off-highway vehicles, and the public is concerned about decreased access and potential impacts to recreation. There is also concern regarding agricultural operations in the Rose Valley, and

regarding the potential impacts to water well owners. The NAWS, China Lake is concerned about development and operations activity conflicts with flight paths and military special use areas.

5.4.8 Noise and Electromagnetic Fields (EMF)

An organization requested evaluation of noise generation and projected noise levels from development in the HGLA, and evaluation of potential impacts to workers and wildlife.

5.4.9 Public Health & Safety

The public is concerned about potential impacts to human health and safety and requested that the potential for wastewater and emission hazards to the public be analyzed.

5.4.10 Socioeconomics

Inyo County inquired about the potential for creation of jobs and revenue generation for the County. The County requested consideration of the potential impacts to the population and housing, and potential for socioeconomic impacts or adverse impacts to the Coso Geothermal Power Plant.

5.4.11 Traffic and Transportation

The California Department of Transportation was concerned about potential highway transportation issues on US 395, such as highway access points for future facilities and transport of construction materials and workforce.

5.4.12 Utilities & Public Services

Scoping meeting attendees questioned whether adequate electrical transmission was available to transfer the geothermal energy to the load centers, and inquired about plans to upgrade the existing transmission lines or need to construct a new substation.

5.4.13 Visual Resources

The Rose Valley supports a number of recreational uses and there is concern regarding visual impacts from the construction of structures and geothermal facilities.

5.4.14 Water Resources

Attendees were concerned about the increasing scarcity of water in California, especially in Rose Valley. Most of the comments received inquired about the water needs for geothermal energy development and production and questioned the source and amount of water appropriations. Rose Valley residents were very concerned about any potential reductions to water resources and the protection of watersheds, water rights, and nearby public lands. The public inquired about the presence of a connection between the GeoReservoir (Coso geothermal source aquifer) and the water basins in the HGLA, and requested evaluation of potential impacts from the use and consumption of the GeoReservoirs (Coso or HGLA geothermal source aquifer) on local water basins. The Native American Tribes were also concerned about the close proximity of the Coso Hot Springs to the HGLA and potential impacts to the hot springs. There was concern for the short and long-term impacts of water extractions.

5.4.15 Cumulative Effects

Many commenters were concerned about the cumulative impacts from existing and proposed geothermal projects such as the Deep Rose and Coso Geothermal Fields. There was also concern regarding large-scale, non-geothermal operations in the vicinity of the HGLA, such as LADWP operations, Owens Lake Dust mitigation, water utilization by Coso's Hay Ranch Water Extraction and Delivery System, and livestock grazing. They were especially concerned about the increasing scarcity of water in California and the needs for groundwater extraction by these projects. The public was concerned that the reasonable foreseeable development scenario was estimated to be too conservative, and may underestimate potential cumulative impacts and future projects and development. Cumulative effects should include an inventory and analysis of the following resources: wetlands (all springs and seeps), regional hydrology, vegetation, wildlife, rare plant and animal species, geology, aesthetic/scenic values, recreation, and dust generation. In addition to geothermal energy development, an evaluation of potential cumulative impacts with future solar and wind energy developments was requested.

5.4.16 Other Comments

The Native American Tribes, Inyo County planners, and local agencies requested additional coordination with and notification by the BLM. A comment was received that questioned a lease applicant's experience and knowledge of geothermal resource exploration and development, and financial capability. Consideration of previous studies, reports, evidence, and comments prepared for projects, such as the Coso Project, was suggested. An organization also requested production of public records in connection with the HGLA.

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CHAPTER 6

LIST

OF

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CHAPTER 7

REFERENCES

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CHAPTER 7 REFERENCES

- Avian Power Line Interaction Committee (APLIC). 2006. Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006. Edison Electric Institute, APLIC, and the California Energy Commission. Washington, D.C. and Sacramento, CA.
- Bartholomew, G. A., and J. W. Hudson. 1960. Mammalian hibernation: aestivation in the Mojave ground squirrel, *Citellus Mojavensis*. *Mus. Comp. Zool. Bull.* 124:193-208.
- Bauer, C.M., 2002: "The Hydrogeology of Rose Valley and Little Lake Ranch, Inyo County, California." Master's thesis, California State University at Bakersfield, 150 p.
- Beck, Craig. 2009. BLM-Ridgecrest Field Office, personal communication with Mark Schaffer, POWER Engineers. November 15, 2009.
- Beier, P. and S. Loe. 1992. A checklist for evaluating impacts to wildlife movement corridors. *Wildlife Society Bulletin* 20: 434-440.
- Berry, K.H. 2008. Threats to Desert Tortoises and Their Habitats. Introduction to Desert Tortoise Surveying, Monitoring, and Handling Techniques Workshop. The Desert Tortoise Council. Ridgecrest, CA. October 25-26, 2008.
- Bevanger, K. 1994. Bird interactions with utility structures: collision and electrocution, causes and mitigating measures. *Ibis* 136: 412-425.
- _____. 1998. Biological and conservation aspects of birds mortality caused by electricity power lines: a review. *Biological Conservation* 86: 67-76.
- Bhattacharyya, J. and Lees, J. M. 2002, Seismicity and seismic stress in the Coso Range, Coso geothermal field, and Indian Wells Valley region, southeast-central California, in Glazner, A.F., Walker, J.D., and Bartley, J.M., eds., *Geologic Evolution of the Mojave Desert and Southwestern Basin and Range: Boulder Colorado*, Geological Society of America Memoir 195, p. 243-257.
- _____. 2002; Seismicity and seismic stress in the Coso Range, Coso geothermal field, and Indian Wells Valley region, southeast-central California, Geological Society of America, Memoir 195, p. 243-257.
- Bloomfield, K.K., Moore, J.N., & Neilson, R. (2003, March-April). CO2 Emissions from Geothermal Energy Facilities are Insignificant Compared to Power Plants Burning Fossil Fuels. *Geothermal Resources Council Bulletin*, 77-79.

- Bondello, M. C. and B. H Brattstrom. 1979. The Experimental Effects of Off-Road Vehicle Sounds on Three Species of Desert Vertebrates. Fullerton, CA, Department of Biological Sciences, California State University.
- Bureau of Land Management (BLM). 1979. BLM Manual 6740, “Wetland Riparian Area Protection and Management”.
- _____. 1980. Field Ecology Technical Report on the Coso Geothermal Study Area in support of the Coso Geothermal Development Environmental Statement. Prepared by Rockwell International. California.
- _____. 1980a. Proposed Leasing with the Coso Known Geothermal Resource Area (KGRA): Final Environmental Impact Statement.
- _____. 1980b. California Desert Conservation Area Plan Environmental Impact Statement (EIS). Desert District, Riverside, California.
- _____. 1985. June 1985. Management Plan for the Rose Spring Area of Critical Environmental Concern (CA-06-ACEC-7). Ridgecrest Resource Area. Approved July, 1985. California Desert District, Moreno Valley, CA.
- _____. 1986a. Manual H-8410-1 - Visual Resource Inventory. BLM.
<http://www.blm.gov/nstc/VRM/8410.html>
- _____. 1986b. Manual H-8431. Visual Resource Contrast Rating. BLM.
<http://www.blm.gov/nstc/VRM/8431.html>.
- _____. 1999. The California Desert Conservation Area Plan 1980 as amended. Bureau of Land Management, Desert District. Riverside California.
- _____. 1999a. Desert Tortoise Biological Evaluation: Proposed Management Prescriptions and Management Areas Identified for the Conservation of the Desert Tortoise (*Gopherus agassizii*) in the West Mojave Desert, California. Unpublished report prepared by the West Mojave Team to document evaluations completed by the U.S. Fish and Wildlife Service and California Department of Fish and Game. Barstow, CA.
- _____. 2000. West Mojave Plan Draft Evaluation Plan. Suggested Conservation Strategies for Mojave Ground Squirrel. Working Draft September 14, 2000.
- _____. 2004. Plans and Plan Amendments – California Desert Conservation Area (1980-2004). CD (Disk 1). California Desert District, Moreno Valley, CA.

- _____. 2005. Final Environmental Impact Report and Statement for the West Mojave Plan, A Habitat Conservation Plan and California Desert Conservation Area Plan Amendment. Vol. 1 and II. California Desert District, Moreno Valley, CA. January 2005.
- _____. 2005. Land Use Planning Handbook, BLM Handbook H-1601-1. March 11, 2005.
- _____. 2007. Final Environmental Impact Statement for the Truckhaven Geothermal Leasing Area. El Centro Field Office, October 2007.
- _____. 2007a. Fossil Falls. Bureau of Land Management, Ridgecrest Field Office. Ridgecrest, California <http://www.blm.gov/ca/st/en/fo/ridgecrest/fossil.html>. Accessed November 27, 2009.
- _____. 2007b. Environmental Assessment, Livestock Grazing Authorization. Olancho Common Allotment. BLM Ridgecrest Field Office, Ridgecrest, CA.
- _____. 2008. Environmental Assessment, Livestock Grazing Authorization. Tunawee Common Allotment. BLM Ridgecrest Field Office, Ridgecrest, CA.
- _____. 2008. Final Programmatic Environmental Impact Statement for Geothermal Leasing in the Western United States. Volume I: Programmatic Analysis.
- _____. 2008. Hay Ranch Water Extraction and Delivery System Environmental Assessment. BLM Ridgecrest Field Office, Ridgecrest, CA.
- _____. 2008. Record of Decision and Resource Management Plan Amendment for Geothermal Leasing in the Western United States.
- _____. 2009. Special status plants of the Ridgecrest Field Office. Ridgecrest, CA. [accessed at <http://www.blm.gov/ca/pa/ssp/fo/ridssp.htm> on 19 November 2009].
- _____. 2009. Environmental Assessment, Livestock Grazing Authorization. Lacey-Cactus-McCloud Allotment. BLM Ridgecrest Field Office, Ridgecrest, CA.
- _____. 2009. Geocommunicator, various reports. Online database provided at: <http://www.geocommunicator.gov/blmMap/Map.jsp?MAP=LAND>
- _____. 2009. Land & Mineral Legacy Rehost 2000 System, Public Mining Claims Report. Online database provided at: <http://www.blm.gov/landandresourcesreports/rptapp/menu.cfm?appCd=2>
- _____. Title 43 Code of Federal Regulations (CFR), Subpart 8364.1(c) Public Lands – Interior, Closures and Restrictions.

BLM and U.S. Forest Service. 2008. Final Programmatic EIS for Geothermal Leasing in the Western United States. Washington, D.C.

California Air Resources Board (CARB). 2010. Ambient Air Quality Standards Chart. <http://www.arb.ca.gov/research/aaqs/aaqs2.pdf>

_____. 2010. ADAM Air Quality Data Statistics. <http://www.arb.ca.gov/adam/topfour/topfourdisplay.php>

California Department of Conservation, Division of Oil, Gas, and Geothermal Resources (DOGGR). Bureau of Land Management, Ridgecrest Field Office. Final Draft Environmental Assessment/Initial Study: Deep Rose Geothermal Exploration Project, Inyo, California. Prepared by Epsilon Systems Solutions, Inc.

California Department of Finance (CDOF). 2007. Population Projections for California and Its Counties 2000-2050, Sacramento, California, July.

_____. 2009. E-4 Population Estimates for Cities, Counties and the State, 2001–2009, with 2000 Benchmark. Sacramento, California, May.

_____. 2009a. Inyo County Profile. http://www.dof.ca.gov/HTML/FS_DATA/profiles/inyo.xls

California Department of Fish and Game (CDFG) 2000. Guidelines for assessing the effects of proposed projects on rare, threatened and endangered plants and natural communities. May 8, 2000. Available at: <http://www.dfg.ca.gov/whdab/pdfs/guideplt.pdf>

_____. 2008. California Interagency Wildlife Task Group. 2008. CWHR version 8.2 personal computer program. Sacramento, CA.

_____. 2009. Natural Diversity DataBase (RareFind 4; CNDDDB). Electronic database. Sacramento, California. DataBase search for the following 7.5-minute USGS quadrangles: Coso Junction, Cactus Peak, Centennial Flat, Haiwee Reservoirs, Little Lake, Upper Centennial Flat, Volcano Peak. [accessed 19 November 2009]. The Resources Agency, Department of Fish and Game, Biogeographic Data Branch, California Natural Diversity Database, Sacramento, CA.

California Department of Water Resources (CDWR). 2004. California's Groundwater Bulletin 118, South Lahontan Hydrologic Region, Rose Valley Groundwater Basin. Updated February 27, 2004. http://www.water.ca.gov/groundwater/bulletin118/south_lahontan.cfm.

California Employment Development Department. 2009. Labor Market Information Division, Industry Employment & Labor Force - by Annual Average, March 2008 Benchmark. October 16.

- _____. 2009a. Labor Market Information Division, Monthly and Annual Employment and Unemployment Data. <http://www.labormarketinfo.edd.ca.gov/cgi/dataanalysis/areaselection.asp?tablename=labforce> Accessed November 2, 2009.
- _____. 2009b. Labor Market Information Division, Monthly Labor Force Data for Cities and Census Designated Places (CDP), Annual Average 2008, Revised. March 20.
- California Energy Commission (CEC) 2009a. *Staff Assessment for the City of Palmdale Hybrid Power Plant*. December. Web site <http://www.energy.ca.gov/2009publications/CEC-700-2009-018/CEC-700-2009-018-PSA.PDF>
- _____. 2009b. *Staff Assessment for the Beacon Solar Project*. October. Web site <http://www.energy.ca.gov/2009publications/CEC-700-2009-005/CEC-700-2009-005-FSA.PDF>
- _____. 2010a. *Staff Assessment for the Abengoa Mojave Solar Project*. March. Web site <http://www.energy.ca.gov/2010publications/CEC-700-2010-003/CEC-700-2010-003.PDF>
- _____. 2010b. *Staff Assessment and Draft Environmental Impact Statement and Draft California Desert Conservation Plan Amendment for the Ridgecrest Solar Power Project*. March. Web site <http://www.energy.ca.gov/2010publications/CEC-700-2010-008/CEC-700-2010-008.PDF>
- California High-Speed Rail Authority (CHSR). 2009. *Report to the Legislature 2009*. Web site http://www.cahighspeedrail.ca.gov/images/chsr/20091223222521_CHSRA_Business_Plan_Dec_2009.pdf
- California Invasive Plant Council (Cal-IPC). 2006. California Invasive Plant Inventory. Cal-IPC Publication 2006-02. California Invasive Plant Council, Berkeley. Available at: www.cal-ipc.org.
- California Native Plant Society (CNPS). 2009. CNPS On-line Inventory. Available at: www.cnps.org [accessed 19 November 2009].
- California Natural Resources Conservation Service (NRCS), United States Department of Agriculture. 2001. Benton-Owens Valley Soils Survey for Haiwee Reservoir, Inyo County, California. 2001.
- _____. 2010. "Soil Survey of Benton-Owens Valley Area, California, Parts of Inyo and Mono Counties." Web Soil Survey. NRCS, USDA. January 19, 2010. <http://websoilsurvey.nrcs.usda.gov/> (accessed January 19, 2010).
- _____. 2010. Web Soil Survey. January 13, 2010. <http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx> (accessed January 14, 2010).

- California Regional Water Quality Control Board, Lahontan Region (RWQCB). 2001. Draft Progress Report, Total Maximum Daily Load for Copper, Haiwee Reservoir, Inyo County, California. June 2001.
- _____. 2005. Water Quality Control Plan for the Lahontan Region, North and South Basins.
- California State Military Museum. n.d. Naval Air Weapons Station, China Lake. California State Military Department. <http://www.militarymuseum.org/NAFINyokern.html>. Accessed November 27, 2009.
- California State Water Resources Control Board (SWRCB). 2009. California's 2006 Clean Water Act Section 303(d) List of Water Quality Limited Segments. www.waterboards.ca.gov/water_issues/programs/tmdl/303d_lists_2006_epa.html.
- Campbell, KM, et al. 2006. Simultaneous microbial reduction of iron(III) and arsenic(V) in suspensions of hydrous ferric oxide. *Environmental Science and Technology* 40(19): 5950-5955.
- Campbell, K. 2006. Biogeochemical mechanisms of arsenic mobilization in Haiwee Reservoir sediments. http://thesis.library.caltech.edu/5043/13/Campbell_Thesis_Complete.pdf
- Carunchio. 2009. County Administrative Officer, submitted to the Inyo County Board of Supervisors. Fiscal Year 2009-2010 Recommended Budget: Budget Message. August 27.
- Christenson, B.W., B. Mack Kennedy, M.C. Adams, S.C. Bjornstad, and C. Buck. 2007, Chemical and Isotopic Characteristics of the Coso East Flank Hydrothermal Fluids: Implications for the Location and Nature of the Heat Source, Proceedings, 32nd Workshop of Geothermal Reservoir Engineering Stanford University, Stanford, California, January 22-24, 2007, SGP-TR-183.
- City of California City. 2009. City of California City Estimated Fund Balances at 6/30/2010. June 6. <http://www.californiacity.com/20092010ccapprovedbudget.pdf>
- City of Ridgecrest. 2009. City of Ridgecrest General Plan Update: Final Environmental Impact Report. September.
- _____. 2009a. Finance Department. City of Ridgecrest And Ridgecrest Redevelopment Agency Draft Budget 2009-10. June 2.
- Clayton, Michael. 2009. Haiwee Visual Resource Management (VRM) Inventory Study, Fall 2009.
- Clel, Georgetta. 1972. Golden Fleece in Nevada. Venture Publishing Company, Reno, NV.

- Cogstone Resource Management, Inc. 2007. *Paleontological Evaluation of 2008 Supplemental Control Requirements for the Owens Valley PM10 Planning Area Demonstration of Attainment State Implementation Plan, Inyo County, California*. Cogstone Resource Management, Inc. Santa Ana, California.
- Coso Operating Company, LLC. 2008. Hay Ranch Water Extraction and Delivery System Environmental Assessment. December 2008.
- Dorp, D. van and P.F.M. Opdam. 1987. Effects of patch size, isolation and regional abundance on forest bird communities. *Landscape Ecology* 1:59-73.
- Ducea, MN, 2001: “The California Arc: Thick Granitic Batholiths, Eclogitic Residues, Lithospheric-Scale Thrusting, And Magmatic Flare-Ups”, *Geological Society of America Today*, 11, 4-10, 2001.
- Duffield, W. A., Bacon, C. A., and Dalrymple, G. B., 1980: Late Cenozoic volcanism, geochronology, and structure of the Coso Range, Inyo County, California, *J. Geophys. Res.* 85 : 2379–2380.
- Egoscue, H. J. 1962. Ecology and life history of the kit fox in Tooele County, Utah. *Ecology* 3:481-497.
- Feller, Walter. n.d. Digital-Desert: Mojave Desert, Boomtown and Mining History. <http://mojavedesert.net/mining-history>. Accessed November 27, 2009.
- Feng, Q. and Lees, J.M. 1998. Microseismicity, stress, and fracture pattern within the Coso geothermal field, *Tectonophysics*, 289, 221-238, 1998.
- Fenneman, N.M. 1931. *Physiography of the Western United States*, New York and London: McGraw Hill, Book Company Inc.
- Garrett, K., and J. Dunn. 1981. *Birds of Southern California. Status and distribution*. Los Angeles Audubon Society, Los Angeles, CA. 408 pp.
- GeoTrans, 2004: “Revised Hydrological Conceptual Model for the Rose Valley,” Prepared for Coso Operating Company by GeoTrans Inc.
- Greater Antelope Valley Economic Alliance. 2009. Economic Roundtable Report: 2009. Lancaster, CA.
- Güler, C. 2002. Hydrogeochemical evaluation of the groundwater resources of Indian Wells-Owens Valley area, southeastern California, PhD. Thesis, Colorado School of Mines, Golden, CO.

- Gum, Linn. 2009. BLM-Ridgecrest Field Office, personal communication with Mark Schaffer, POWER Engineers. November 6, 2009.
- Hanson, Elaine. 2009. BLM-Ridgecrest Field Office, personal communication with Mark Schaffer, POWER Engineers. November 3, 2009.
- Harris, Glenn. 2009. BLM-Ridgecrest Field Office, personal communication with Mark Schaffer, POWER Engineers. November 18, 2009.
- _____. 2010. BLM-Ridgecrest Field Office, personal communication with Katherine Knapp, POWER Engineers.
- Haug, E. A., B. A. Millsap and M. S. Martell _____. 1993. Burrowing Owls (*Speotyto cunicularia*). In A. Poole and F. Gill, editors. *The birds of North America*, No. 61. The Academy of Natural Sciences, Philadelphia, Pennsylvania; The American Ornithologists' Union, Washington, DC.
- _____. 1993. Burrowing Owl (*Athene cunicularia*), *The Birds of North America Online* (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: <http://bna.birds.cornell.edu/bna/species/061>
- Hickman, J.C. 1993. *The Jepson Manual, Higher Plants of California*. University of California Press, Berkeley and Los Angeles, CA. 1400 pp.
- Holland, R. F. 1986. Preliminary descriptions of the terrestrial natural communities of California. California Department of Fish and Game. Unpublished report.
- http://vulcan.wr.usgs.gov/Vhp/C1073/active_volcanoes_USA.html
- International Code Council, Inc. 2009. *International Building Code*. February 2009. http://www2.iccsafe.org/states/2009ICodes/Building/Building_Frameset.html (accessed January 19, 2010).
- Inyo County. 2001. General Plan, Section 9, "Public Safety Element (Noise Section), and Section 4, "Land Use Element", December 2001.
- _____. 2009. *Inyo County Regional Transportation Plan*.
- Inyo County Planning Department. 2001. Inyo County General Plan. Approved December 11, 2001.
- Inyo County Water Department, 2009. Coso / Hay Ranch Hydrologic Monitoring, at <http://www.inyowater.org/coso/default.html> accessed December 4, 2009.

- Jackson, D. B. and O'Donnell, J. E., 1980. Reconnaissance electrical surveys in the Coso Range, California, *J. Geophys. Res.* **85** : 2502–2516
- Jennings, W. B. 1997. Habitat use and food preferences of the desert tortoise, *Gopherus agassizii*, in the western Mojave Desert and impacts of off-road vehicles. In J. Van Abbema (ed.), *Proceedings: Conservation, Restoration, and Management of Tortoises and Turtles – An International Conference*, pp. 42 – 45. New York Turtle and Tortoise Society, New York.
- Jepson Online Interchange. 2008. An online database for California floristics. Available at: <http://ucjeps.berkeley.edu/interchange.html>
- Kagel, Alyssa; Bates, Diana; Gawell, Karl. 2005. A guide to geothermal energy and the environment. Washington, DC: Geothermal Energy Association. pp 28
- Kern County. 2007. *Kern County General Plan*.
- _____. 2009. *Alta-Oak Creek Mojave Project Draft Environmental Impact Report*. August. Web page <http://www.co.kern.ca.us/planning/pdfs/eirs/AltaOakCreek>
- Kneebone, Penelope E. (2000) *Arsenic geochemistry in a geothermally impacted system: the Los Angeles Aqueduct*. Dissertation Pasadena, CA: California Institute of Technology.
- _____. 2002. Deposition and fate of arsenic in iron- and arsenic-enriched reservoir sediments. *Environmental Science and Technology* 35(3): 381-386.
- LaBerteaux, D.L., 2009. Biological Resource Survey at the Proposed Little Lake Wind Energy Meteorological Mast Sites, Inyo County, California. Prepared for Little Lake North Wind, LLC and Little Lake South Renewables, LLC, Broomfield, CO.
- LADWP, 2009: Los Angeles Aqueduct Real-Time Data, Southern District, So. Haiwee Reservoir Elevation, at <http://wsoweb.ladwp.com/Aqueduct/realtime/sdrealtime.htm> accessed December 4, 2009.
- Landry, R.E. 1979. Growth and Development of the Burrowing Owl. M.S. thesis, California State University, Long Beach, CA.
- Leitner, P. and B. M. Leitner. 1989. First year baseline report: Coso grazing exclosure monitoring study: Coso Known Geothermal Resource Area, Inyo County, California. McClenahan and Hopkins Associates (San Mateo, CA) report, 69 pp + appendices.
- _____. 1990. Second year baseline report: Coso grazing exclosure monitoring study: Coso Known Geothermal Resource Area, Inyo County, California. McClenahan and Hopkins Associates (Bethesda, MD) report, 96 pp.

- Leitner, P., B. M. Leitner and J. H. Harris. 1997. Mojave ground squirrel study in the Coso Known Geothermal Resource Area, Inyo County, California, 1995 and 1996. Unpublished report prepared on behalf of CalEnergy Company, Inc. Orinda, CA.
- Lennartz, S., T. Bax, J. Aycrigg, A. Davison, M., Reid, and R. Congalton. 2008. Final Report on Land Cover Mapping Methods for California Map Zones 3, 4, 5, 6, 12, and 13. USGS GAP Program: Portland, OR.
- Los Angeles County Economic Development Corporation. 2009. With the Kyser Center for Economic Research. 2009-2010 Midyear Update, Economic Forecast and Industry Outlook. July 2009.
- Los Angeles Department of Water and Power. n.d. The Story of the Los Angeles Aqueduct. <http://wsoweb.ladwp.com/Aqueduct/historyoflaa/index.htm>. Accessed November 27, 2009.
- MHA Environmental Consultanting (MHA). 2008. "Coso Operating Company, Hay Ranch Water Extraction and Delivery System, Conditional Use Permit (CUP 2007-003) Application. SCH# 2007101002, Draft EIR, Inyo County, California, July 2008", Prepared for: Inyo County Planning Department by MHA Environmental Consulting.
- MHA-RMT. 2009. Hay Ranch Water Extraction Project Final EIR, Inyo County Planning Department, Lone Pine, CA.; Fournier, Robert O. and J.M. Thompson, 1980,"The Recharge Area for the Coso, California, Geothermal System deduced from ∂D and $\partial 18O$ in Thermal and Non-Thermal Waters in the Region", USGS Open-File Report 80-454.; Güler, 2002; MHARMT. 2009.
- Monastero, Francis C. 2002. Geothermal Development: Model for Success. Geothermal Resource Council Bulletin, September / October: 188-194.
- Moose, Virgil. 2009. Subject: Comments on Proposed Haiwee Geothermal leasing Area. Letter to John Dalton, Haiwee Geothermal Leasing Coordinator, BLM. Submitted November 19, 2009 by Tribal Chairperson, Big Paine Paiute Tribe of the Owens Valley, Big Pine Indian Reservation, Big Pine, California.
- Natural Resources Conservation Service (NRCS). 2010."Soil Survey of Benton-Owens Valley Area, California, Parts of Inyo and Mono Counties." Web Soil Survey. January 19, 2010. <http://websoilsurvey.nrcs.usda.gov/> (accessed January 19, 2010).
- NatureServe. 2008. Ecological systems of California. International Ecological Classification Standard: Terrestrial Ecological Classifications. Arlington, VA. Data current as of 18 December 2008.

- Néron-Bancel. 2009. Research Associate, Geothermal Energy Association. Geothermal Revenue Under the Energy Policy Act of 2005: Income Distribution at Federal, State, and County Levels. December 14.
- Parker, P.L., King, T.F., 1998. Guidelines for Evaluating and Documenting Traditional Cultural Properties, National Register Bulletin, National Register of Historic Places, National Park Service, U.S. Department of the Interior, Washington, D.C.
- Porter, Randy. 2009. BLM-Ridgecrest Field Office, personal communication with Mark Schaffer, POWER Engineers. November 9 and 10, 2009.
- Powers, Bob.1988. Cowboy Country. H. Clark Company, Glendale, CA.
- Reheis, MC. (1997), Dust deposition downwind of Owens (dry) Lake,1991 – 1994: Preliminary findings, Journal of Geophysical Research.
- Reheis, MC; Budahn, JR; Lamothe, PJ; Reynolds, RL. 2009. Compositions of modern dust and surface sediments in the Desert Southwest, United States. Journal of Geophysical Research 114: http://esp.cr.usgs.gov/info/sw/swdust/dust_composition.pdf.
- Rockwell International. 1980. Soils Technical Report on the Coso Geothermal Study Area. Technical Report, Newbury Park, 1980.
- _____. 1980: “Project: Geology and Hydrology Technical Report on the Coso Geothermal Study Area, In Support of: Coso Geothermal Development Environmental Statement”, April 1980, prepared for U.S. Department of the Interior, Bureau of Land Management, by Rockwell International.
- Rodriquez, Paul. 2009. BLM-Ridgecrest Field Office, personal communication with Mark Schaffer, POWER Engineers. November 10, 2009.
- Rogers, D., C. Millar, and R. Westfall. 1996. Genetic Diversity within Species. Sierra Nevada Ecosystem Project: Final report to Congress, vol. II, Assessments and scientific basis for management options. Davis: University of California, Centers for Water and Wildland Resources, 1996.
- San Diego Gas and Electric (SDG&E). 2006. Sunrise Powerlink Project Environmental Assessment. Prepared for California Public Utilities Commission. San Diego, CA.
- Sawyer, J. and T. Keeler-Wolf. 1995. A manual of California vegetation. California Native Plant Society, Sacramento.

- Sergio, F., L. Marchesi, P. Pedrini, M. Ferrer, and V. Penteriani. 2005. Electrocution alters the distribution and density of a top predator, the eagle owl *Bubo bubo*. *Journal of Applied Ecology*, 21:836-845.
- Shuford, W.D., and Gardali, T. editors. 2008. California Bird Species of Special Concern: A ranked assessment of species, subspecies, and distinct populations of bird of immediate conservation concern in California. *Studies of Western Birds* 1. Western Field Ornithologists, Camarillo, California, California, and California Department of Fish and Game, Sacramento.
- State of California, Office of Planning and Research. 2008. R-2508 Joint Land Use Study.
- Stebbins, R. C. 2003. A field guide to western reptiles and amphibians. Third edition. Houghton Mifflin Co., New York, NY. 533 pp.
- Storm, Donald. 2009. Personal Communication. Archaeologist, Bureau of Land Management, Ridgecrest Field Office. Ridgecrest, California.
- Thomsen, L. 1971. Behavior and Ecology of Burrowing Owls on the Oakland Municipal Airport. *Condor* 73:177-192.
- United States Army Corps of Engineers (USACE). September 2008. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0).
- United States Department of Agricultural (USDA). 2009. The PLANTS Database (<http://plants.usda.gov>, 20 November 2009). National Plant Data Center, Baton Rouge, LA.
- United States Department of Commerce. 2000. Bureau of the Census. 2000 Census of the Population.
- _____. 2000a. Bureau of the Census. 2000 Census of the Population. Table P52. Summary File 3 (SF 3).
- _____. 2009. Bureau of Economic Analysis, Regional Economic Information System. Table C-4. April 2009.
- _____. 2009a. Bureau of Economic Analysis, Regional Economic Information System. Table CA25N.
- United States Department of Energy (DOE). 2002. Environmental Assessment for a Small-Scale Geothermal Power Plant and Direct-Use Geothermal Application at AmeriCulture Inc., Cotton City, NM. EA 1396. August 2002.
- United States Environmental Protection Agency (USEPA). 2003. Primary Drinking Water Standards. www.epa.gov

- _____. 2010. The Green Book Nonattainment Areas for Criteria Pollutants. <http://epa.gov/airquality/greenbk/>
- United States Fish and Wildlife Service (USFWS). 1994a. Desert tortoise (Mojave populations) Recovery Plan. U.S. Fish and Wildlife Service, Portland Oregon. 73 pages plus appendices.
- _____. 2003. Status Assessment and Conservation Plan for the Western Burrowing Owl in the United States. Biological Technical Publication BTP-R6001-2003.
- _____. 2006b. Biological opinion for the California Desert Conservation Area Plan [West Mojave Plan] (1-8-03-F*58). Dated January 9, 2006. From the Field Supervisor, Ventura Fish and Wildlife Office, Ventura, California.
- _____. 2007. National Bald Eagle Management Guidelines. U.S. Fish and Wildlife Service. Portland, Oregon. 23pp.
- _____. 2008. Draft revised recovery plan for the Mojave population of the desert tortoise (*Gopherus agassizii*). U.S. Fish and Wildlife Service, California and Nevada Region, Sacramento, California. 209 pp.
- _____. 2009. Letter to POWER Engineers, December 2009. Species List for the Proposed Leasing of Geothermal Resources within the Haiwee Geothermal Leasing Area, Inyo County, California
- _____. 2009c. Biological opinion for a Right-of-Way Grant for the Coso Hay Ranch Pipeline, Inyo County, California (1-8-08-F-42). Dated December 17, 2008. From Assistant Field Supervisor Ventura Fish and Wildlife Office. Ventura, California.
- _____. 2010. http://www.fws.gov/ventura/speciesinfo/protocols_guidelines/.
- United States Forest Service (USFS). 1997. Pacific Southwest Region. Ecological Subregions of California, Section and Subsection Descriptions. USFS. <http://www.fs.fed.us/r5/projects/ecoregions>.
- United States Geological Survey (USGS) GAP Program. 2009. GAP Ecological Systems: California ReGAP. Portland, OR. [accessed at: http://gapanalysis.nbii.gov/portal/community/GAP_Analysis_Program/Communities/Maps_Data_&_Reports/Find_Updated_GAP_Regional_Data/].
- United States Navy. 2007. Naval Air Weapons Station, China Lake. Final Air Installation Compatible Use Study.

- Unruh, Jeffrey, Satish Pullammanappallil, William Honjas, and Francis Monastero, 2001. "New Seismic Imaging of the Coso Geothermal Field, Eastern California, Proceedings 26th Workshop on Geothermal Reservoir Engineering, Stanford University, Stanford, CA, January 2001.
- Unruh, Jesse, James Humphrey and Andrew Barron, 2003; Transtensional model for the Sierra Nevada frontal fault system, eastern California, Geological Society of America, April 2003, v. 31, p. 327-330.
- USGS, 2009: Comments by the U.S. Geological Survey on "Environmental Assessment for the Coso Operating Company Hay Ranch Water Extraction and Delivery System, CA Bureau of Land Management, December 2008, June 4, 2009, prepared for the U.S. Bureau of Land Management.
- Voous, K.H. 1988. *Owls of the Northern Hemisphere*. MIT Press, Cambridge, Massachusetts.
- Western Regional Climate Center (WRCC). 2010. Haiwee, California (043710). Period of Record Monthly Climate Summary. Period of Record: 5/1/1923 to 11/30/2009. <http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca3710>.
- _____. 2010. Annual Average Temperature Records for Haiwee Meteorological Station, Station No. 043710. Available at <http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca3710>.
- Whitmarsh, Richard S. 1997. *Geologic Map of the Coso Junction 7.5' Quadrangle, Inyo County, California*.
- Williams, D. F. 1986. Mammalian species of special concern in California. California Department of Fish and Game, Sacramento, CA. 112 pp.
- Williams, David V., 2004, "Hydrologic and Hydrochemical Framework of Indian Wells Valley, California: Evidence for Intrabasin Flow in the Southern Sierra Nevada" Master's Thesis, Colorado School of Mines, Golden, CO.
- Wilson, Charles K., Craig H. Jones and Hersch Gilbert. 2003. "Single-chamber silicic magma system inferred from shear wave discontinuities of the crust and uppermost mantle, Coso geothermal area, California"; JGR, vol. 108; No. B5, 2226.
- Wohletz, Kenneth and Heiken, Grant, 1992: *Volcanology and Geothermal Energy*, Chapter 5 – Coso California Geothermal Field, University of California Press; Berkeley, CA; p. 194-205.
- Yousef, R. 1996. Loggerhead Shrike (*Lanius ludovicianus*), The Birds of Northern America Online (A. Poole, Ed.) Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: <http://bna.birds.cornell.edu/bna/species/231>

Zarn, M. 1974. Burrowing Owl. Rep. No. 11. Habitat Management Series for Unique or Endangered Species. USDI, BLM. Technical Note T-N 250. Denver, Colorado.

Zerabel, R., C. Gall, D. Kruska, and P. Lobnitz. 1979. An Inventory of the Vascular Plants and Small Mammals of the Coso Hot Springs Area of Inyo County, California. Report prepared for the Natural Resource Management Office Public Works Department, April 1979.

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